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THE DANISH "DANA"-EXPEDITIONS 1920—22
IN THE NORTH ATLANTIC AND THE GULF OF PANAMA

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THE PEDICULATE FISHES OF THE SUBORDER CERATIOIDEA

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1. INTRODUCTION

THE fishes of the order PEDICULATI are characterized by the structure of the spinous dorsal fin, which is formed of a few flexible rays, the first of these — conveniently termed the *illicium* — being placed on top of the head and modified into a line and bait. The osteological characters of the order are well-marked, especially if the Batrachoids be excluded. In a memoir on the classification of the Pediculati (Ann. Mag. Nat. Hist. (8) IX, 1912, p. 277) I included the Batrachoids; but although the resemblances in the pectoral arch may be due to relationship, the differences in other characters are sufficient to keep them apart.

Of the three suborders of the Pediculati the Lophioids and Antennarioids are, with few exceptions, dwellers on the bottom in shallow or moderately deep water, but the Ceratioids are oceanic, nearly all living in mid-water, probably from about 500 to 1500 metres below the surface, although larvae and very young fish may occur nearer the surface. The majority of the Ceratioids are uniformly blackish in colour and have the bait represented by a luminous bulb.

For many years the only known Ceratioids were two large northern species, *Himantolophus groenlandicus* (Reinhardt, 1837) and *Ceratias holboelli* (Kröyer, 1844). In 1864 GÜNTHER described *Melanocetus johnsoni* from Madeira and at intervals other new forms were described, generally each from a single specimen, so that in the "Challenger" Report (1887) GÜNTHER gave a list of 8 genera and 11 species, known from 13 specimens. GOODE and BEAN (1896) listed 13 species and in 1906 BRAUER enumerated 23, but some of these I regard as synonyms. Prior to the "Dana" Expedition, (and excluding the "Michael Sars" collection,[1] as yet undescribed) I estimate that about 60 examples of this group were known, belonging to 16 genera and 24 species.

The "Dana" collection from the North Atlantic, the Caribbean Sea and the Gulf of Panama comprises about 220 specimens (excluding larval and most post-larval examples, but including about 110 specimens that measure not more than an inch in total length, including the caudal fin). Thirty-nine species are represented, twenty-four[2] of which have recently been described by me as new to science, eight being the types of new genera. Three more new species, one the type of a new genus, are described below.

It will readily be seen that the "Dana" collection of Ceratioids far exceeds in importance any previously made, and greatly extends our knowledge of the group. I am deeply indebted to Prof. JOHS. SCHMIDT for the privilege of working on this magnificient material.

[1] The Ceratioids collected by the "Michael Sars" have been figured by MURRAY and HJORT (Depths of the Ocean, 1912). They include examples of *Cryptosparas couesii*, *Haplophryne mollis* and *Aceratias indicus*; two species of *Melanocetus* are listed, namely *M. johnsoni* and *M. krechi*, but, assuming that these have been determined with the aid of BRAUER's 'Valdivia' report, it is probable that they are *M. murrayi* and *M. johnsoni* respectively. A fish of 130 mm (fig. 59) appears to be a young example of *Ceratias holboelli*, the first evidence that this species is not restricted to northern waters. Of four small fishes figured as species of *Oneirodes* one (fig. 90) may be *Lophodolus acanthognathus*, and the others (fig. 81, 467, 468) may be *Dolopichthys megaceros*.

[2] One of these has since proved to be a synonym.

2. LIST OF THE FAMILIES, GENERA AND SPECIES OF CERATIOID FISHES

Order *Pediculati.*

Suborder *Ceratioidea.*

Family 1. **Photocorynidae.**

1. *Photocorynus*, Regan, 1925.
   1. *spiniceps*, Regan, 1925.

Family 2. **Caulophrynidae.**

1. *Caulophryne*, Goode & Bean, 1896.
   1. *jordani*, Goode & Bean, 1896.

Family 3. **Linophrynidae.**

1. *Acentrophryne*, gen. nov.
   1. *longidens*, sp. n.
2. *Borophryne*, Regan, 1925.
   1. *apogon*, Regan, 1925.
3. *Linophryne*, Collett, 1886.
   1. *lucifer*, Collett, 1886.
   2. *macrodon*, Regan, 1925,
   3. *arborifer*, Regan, 1925.
   4. *polypogon*, Regan, 1925.
4. *Edriolychnus*, Regan, 1925.
   1. *schmidti*, Regan, 1925.
5. *Haplophryne*, Regan, 1912.
   1. *mollis*, Brauer, 1902.

Family 4. **Oneirodidae.**

1. *Oneirodes*, Lütken, 1871.
   1. *eschrichtii*, Lütken, 1871.
2. *Dolopichthys*, Garman, 1899.
   1. *luetkeni*, Regan, 1925.
   2. *allector*, Garman, 1899.
   3. *heteracanthus*, Regan, 1925.
   4. *acanthias*, Gilbert, 1915.
   5. *microlophus*, Regan, 1925.
   6. *danae*, sp. n.
   7. *megaceros*, Holt and Byrne, 1908.
   8. *platynogaster*, Radcliffe, 1912.
   9. *gracilispinis*, Regan, 1925.
3. *Lophodolus*, Lloyd, 1909.
   1. *acanthognathus*, Regan, 1925.
   2. *indicus*, Lloyd, 1909.
4. *Chaenophryne*, Regan, 1925.
   1. *longiceps*, Regan, 1925.
5. *Lasiognathus*, Regan, 1925.
   1. *saccostoma*, Regan, 1925.
6. *Thaumatichthys*, Smith and Radcliffe, 1912.
   1. *pagidostomus*, Smith and Radcliffe, 1912.

Family 5. **Melanocetidae.**

1. *Melanocetus*, Günther, 1864.
   1. *murrayi*, Günther, 1887.
   2. *ferox*, sp. n.
   3. *johnsoni*, Günther, 1864.
   4. *niger*, Regan, 1925.
   5. *polyactis*, Regan, 1925.

Family 6. **Ceratiidae.**

1. *Ceratias*, Kröyer, 1844.
   1. *holboelli*, Kröyer, 1844.
2. *Cryptosparas*, Gill, 1883.
   1. *couesii*, Gill, 1883.
   2. *mitsukurii*, Tanaka, 1908.
3. *Mancalias*, Gill, 1878.
   1. *uranoscopus*, Murray, 1878.

Family 7. **Gigantactinidae.**

1. *Gigantactis*, Brauer, 1902.
   1. *vanhoeffeni*, Brauer, 1902.
   2. *gracilicauda*, Regan, 1925.
   3. *macronema*, Regan, 1925.
2. *Rhynchactis*, Regan 1925.
   1. *leptonema*, Regan, 1925.

Family 8. **Neoceratiidae.**

1. *Neoceratias*, Pappenheim, 1914.
   1. *spinifer*, Pappenheim, 1914.

Family 9. **Himantolophidae.**

1. *Himantolophus*, Reinhardt, 1837.
   1. *groenlandicus*, Reinhardt, 1837.
   2. *appelii*, Clark, 1878.
2. *Diceratias*, Günther, 1887.
   1. *bispinosus*, Günther, 1887.
   2. *glomerulosus*, Alcock, 1890.

Family 10. **Aceratiidae.**

1. *Lipactis*, Regan, 1925.
   1. *tumidus*, Regan, 1925.

2. *Rhynchoceratias*, Regan, 1925.
   1. *brevirostris*, Regan, 1925.
   2. *leucorhinus*, Regan, 1925.
   3. *oncorhynchus*, Regan, 1925.
   4. *rostratus*, Regan, 1925.
3. *Aceratias*, Brauer, 1902.
   1. *indicus*, Brauer 1902.
   2. *macrorhinus*, Brauer, 1902.

3. STATIONS AT WHICH CERATIOID FISHES WERE TAKEN[1], WITH LIST OF SPECIMENS[2]

St. 829. Atlantic. (25° 07′ N. 19° 20′ W.).
- 300 metres w. ..... 1 *Haplophryne mollis* (43 mm.).

St. 1019. Atlantic. 31° 06′ N. 41° 45′ W.).
- 150 metres w. ..... 1 *Cryptosparas couesii* (15 mm.).

St. 1024. Atlantic. (42° 19′ N. 50° 22′ W.).
- 300 metres w. ..... 1 *Cryptosparas couesii* (18 mm.).

St. 1041. Atlantic. (29° 43′ N. 57° 28′ W.).
- 150 metres w. ..... 1 *Cryptosparas couesii* (23 mm.).
- 110 „ „ ..... 1 *Cryptosparas couesii* (18 mm.).

St. 1043. Atlantic. (31° 59′ N. 59° 52′ W.).
- 150 metres w. ..... 1 *Cryptosparas couesii* (18 mm.).

St. 1140. Atlantic. (32° 45′ N. 16° 20′ W.).
- 300 metres w. ..... 1 *Dolopichthys luetkeni* (24 mm.).

St. 1142. Atlantic. (33° 26′ N. 16° 59′ W.).
- 5000 metres w. ..... 1 *Linophryne polypogon* (45 mm.).
- „ „ „ ..... 1 *Rhynchoceratias leucorhinus* (21 mm.).
- „ „ „ ..... 2 *Aceratias indicus* (20, 22 mm.).
- 4000 „ „ ..... 3 *Himantolophus groenlandicus* (13—18 mm.).
- 3000 „ „ ..... 1 *Dolopichthys danae* (24 mm.).

St. 1152. Atlantic. (30° 17′ N. 20° 44′ W.).
- 7000 metres w. ..... 1 *Melanocetus johnsoni* (85 mm.).
- 3000 „ „ ..... 1 *Dolopichthys megaceros* (38 mm.).
- „ „ „ ..... 1 *Chaenophryne longiceps* (15 mm.).
- „ „ „ ..... 1 *Lipactis tumidus* (10 mm.).
- „ „ „ ..... 1 *Aceratias indicus* (20 mm.).

St. 1154. Atlantic. (27° 58′ N. 20° 52′ W.).
- 100 metres w. ..... 1 *Lipactis tumidus* (24 mm.).

St. 1156. Atlantic. (25° 11′ N. 20° 57′ W.).
- 6000 metres w. ..... 1 *Edriolychnus schmidti* (35 mm.).
- „ „ „ ..... 1 *Aceratias indicus* (21 mm.).
- 5000 „ „ ..... 1 *Melanocetus murrayi* (110 mm.).
- „ „ „ ..... 1 *Dolopichthys* sp. (12 mm.).
- „ „ „ ..... 1 *Gigantactis vanhoeffeni* (30 mm.).

[1] These are all "Dana" stations 1921—22 except St. 829 (Motor-schooner "Dana" 1920) and 1019 to 1043 (Motor-schooner "Margrethe" 1913).

[2] The number of metres indicates the length of wire out; it has been calculated that for the greater depths this is about twice and for the lesser ones about three times the depth at which the net was fishing; although this may frequently be the depth at which the fish were caught, it is evident that some were captured when the net was on its way to the surface. The total length (caudal fin included) of each specimen is given in brackets after the specific name.

St. 1156. Atlantic. (25° 11′ N. 20° 57′ W.) [continued].
5000 metres w. ... 1 *Rhynchoceratias oncorhynchus* (30 mm.).
3000 „ „ ... 1 *Melanocetus johnsoni* (26 mm.).
1000 „ „ ... 1 *Melanocetus johnsoni* (60 mm.).
St. 1157. Atlantic. (21° 57′ N. 22° 58′ W.).
5000 metres w. ... 4 *Melanocetus johnsoni* (21—26 mm.).
2000 „ „ ... 1 *Melanocetus johnsoni* (20 mm.).
1000 „ „ ... 1 *Melanocetus johnsoni* (90 mm.).
St. 1159. Atlantic. (17° 55′ N. 24° 35′ W.).
5000 metres w. ... 1 *Melanocetus johnsoni* (20 mm.).
3000 „ „ ... 1 *Dolopichthys microlophus* (34 mm.).
St. 1160. Atlantic. (15° 50′ N. 26° 32′ W.).
1000 metres. w. ... 1 *Oneirodes eschrichtii* (205 mm.).
St. 1161. Atlantic. (14° 52′ N. 28° 04′ W.).
600 metres w. ... 1 *Linophryne arborifer* (70 mm).
St. 1162. Atlantic. (13° 35′ N. 30° 11′ W.).
300 metres w. ... 1 *Cryptosparas couesii* (26 mm.).
St. 1165. Atlantic. (12° 11′ N. 35° 49′ W.).
3000 metres w. ... 2 *Dolopichthys megaceros* (28, 81 mm.).
2000 „ „ ... 1 *Melanocetus johnsoni* (20 mm.).
St. 1166. Atlantic. (10° 16′ N. 40° 41′ W.).
1000 metres w. ... 1 *Melanocetus johnsoni* (50 mm.).
„ „ „ ... 1 *Himantolophus groenlandicus* (47 mm.).
St. 1168. Atlantic. (9° 30′ N. 42° 41′ W.).
600 metres w. ... 1 *Cryptosparas couesii* (24 mm.).
300 „ „ ... 1 *Cryptosparas couesii* (23 mm.).
St. 1171. Atlantic. (8° 19′ N. 44° 35′ W.).
6000 metres w. ... 1 *Dolopichthys danae* (95 mm.).
„ „ „ ... 1 *Melanocetus johnsoni* (27 mm.).
„ „ „ ... 1 *Rhynchoceratias brevirostris* (40 mm.).
„ „ „ ... 1 *Rhynchoceratias oncorhynchus* (45 mm.).
4000 „ „ ... 1 *Lipactis tumidus* (33 mm.).
3000 „ „ ... 1 *Rhynchactis leptonema* (57 mm.).
St. 1172. Atlantic. (7° 22′ N. 46° 51′ W.).
600 metres w. ... 1 *Cryptosparas couesii* (25 mm.).
„ „ „ ... 1 *Mancalias uranoscopus* (110 mm.).
St. 1181. Atlantic. (13° 07′ N. 57° 20′ W.).
4000 metres w. ... 1 *Gigantactis vanhoeffeni* (70 mm.).
St. 1183. Caribbean Sea, W. of St. Lucia. (13° 47′ N. 61° 26′ W.).
4500 metres w. ... 1 *Dolopichthys megaceros* (42 mm.).
„ „ „ ... 1 *Gigantactis gracilicauda* (107 mm.).
„ „ „ ... 1 *Edriolychnus schmidti* (63 mm.).
3500 „ „ ... 1 *Melanocetus johnsoni* (16 mm.).
St. 1186. Caribbean Sea, S. of Virgin Islands. (17° 54′ N. 64° 54′ W.).
4000 metres w. ... 1 *Lipactis tumidus* (33 mm.).
3000 „ „ ... 1 *Lipactis tumidus* (25 mm.).
„ „ „ ... 1 *Melanocetus johnsoni* (16 mm.).

St. 1189. Caribbean Sea, S. of Virgin Islands. (17° 58.5′ N. 64° 41′ W.).

5000 metres w.	1	*Melanocetus murrayi* (45 mm.).
4000 „ „	1	*Rhynchoceratias oncorhynchus* (39 mm.).

St. 1203. Gulf of Panama. (7° 30′ N. 79° 19′ W.).

3500 metres w.	1	*Edriolychnus schmidti* (53 mm.).
„ „ „	1	*Dolopichthys luetkeni* (160 mm.).
3000 „ „	2	*Rhynchoceratias leucorhinus* (15, 18 mm.).
„ „ „	3	*Chaenophryne longiceps* (15—27 mm.).
2500 „ „	1	*Dolopichthys allector* (20 mm.).
„ „ „	4	*Dolopichthys heteracanthus* (38—86 mm.).
„ „ „	1	*Chaenophryne longiceps* (55 mm.).
„ „ „	1	*Melanocetus niger* (50 mm.).
„ „ „	1	*Acentrophryne longidens* (75 mm.).
2000 „ „	2	*Dolopichthys heteracanthus* (21, 90 mm).

St. 1205. Gulf of Panama. (6° 49′ N. 80° 25′ W.).

1000 metres w.	1	*Dolopichthys heteracanthus* (42 mm.).
„ „ „	1	*Melanocetus niger* (40 mm.).

St. 1206. Gulf of Panama. (6° 40′ N. 80° 47′ W.).

4500 metres w.	2	*Aceratias macrorhinus* (22 mm.).
4000 „ „	2	*Dolopichthys heteracanthus* (27, 65 mm.).
3500 „ „	1	*Melanocetus polyactis* (90 mm.).
„ „ „	1	*Dolopichthys gracilispinis* (65 mm.).
3000 „ „	4	*Rhynchoceratias leucorhinus* (16—18 mm.).
„ „ „	1	*Dolopichthys allector* (22 mm.).
2500 „ „	1	*Dolopichthys allector* (48 mm.).
„ „ „	1	*Rhynchoceratias leucorhinus* (16 mm.).
1200 „ „	1	*Aceratias macrorhinus* (19 mm.).
„ „ „	1	*Dolopichthys heteracanthus* (60 mm.).

St. 1208. Gulf of Panama. (6° 48′ N. 80° 33′ W.).

3600 metres w.	1	*Melanocetus niger* (70 mm.).
„ „ „	1	*Aceratias macrorhinus* (25 mm.).
3500 „ „	3	*Melanocetus niger* (60, 65, 100 mm.).
„ „ „	1	*Dolopichthys heteracanthus* (18 mm.).
„ „ „	1	*Borophryne apogon* (40 mm.).
„ „ „	1	*Aceratias macrorhinus* (22 mm.).
„ „ „	1	*Linophryne macrodon* (53 mm.).
„ „ „	1	*Rhynchoceratias rostratus* (30 mm.).
3100 „ „	2	*Dolopichthys heteracanthus* (25, 33 mm.).
„ „ „	1	*Melanocetus niger* (22 mm.).
„ „ „	1	*Melanocetus ferox* (110 mm.).
„ „ „	2	*Rhynchoceratias leucorhinus* (16, 17 mm.).
3000 „ „	2	*Melanocetus niger* (19, 45 mm.).
„ „ „	2	*Rhynchoceratias leucorhinus* (17, 25 mm.).
2600 „ „	3	*Dolopichthys allector* (18, 25, 26 mm.).
„ „ „	3	*Chaenophryne longiceps* (17—19 mm.).
„ „ „	1	*Rhynchoceratias leucorhinus* (16 mm.).
2500 „ „	2	*Dolopichthys allector* (25, 28 mm.).

St. 1208. Gulf of Panama (6° 48′ N. 80° 33′ W.) [continued].

2500 metres w. . . . . 1 *Dolopichthys heteracanthus* (16 mm.).
„ „ „ . . . . . 2 *Chaenophryne longiceps* (17 mm.).
„ „ „ . . . . . 1 *Rhynchoceratias leucorhinus* (22 mm.).
2100 „ „ . . . . . 1 *Dolopichthys allector* (13 mm.).
„ „ „ . . . . . 1 *Chaenophryne longiceps* (30 mm.).
„ „ „ . . . . . 1 *Dolopichthys heteracanthus* (40 mm.).
„ „ „ . . . . . 1 *Cryptosparas couesii* (16 mm.).
2000 „ „ . . . . . 1 *Chaenophryne longiceps* (18 mm.).
1500 „ „ . . . . . 2 *Dolopichthys heteracanthus* (25, 35 mm.).

St. 1209. Gulf of Panama. (7° 15′ N. 78° 54′ W.).

3500 metres w. . . . . 1 *Photocorynus spiniceps* (50 mm.).
„ „ „ . . . . . 1 *Caulophryne jordani* (90 mm.).
„ „ „ . . . . . 3 *Borophryne apogon* (60—83 mm.).
„ „ „ . . . . . 1 *Dolopichthys allector* (25 mm.).
„ „ „ . . . . . 1 *Chaenophryne longiceps* (19 mm.).
„ „ „ . . . . . 1 *Melanocetus niger* (55 mm.).
„ „ „ . . . . . 1 *Melanocetus polyactis* (75 mm.).
„ „ „ . . . . . 1 *Rhynchoceratias rostratus* (38 mm.).
„ „ „ . . . . . 2 *Aceratias macrorhinus* (26 mm.).
3000 „ „ . . . . . 1 *Dolopichthys heteracanthus* (20 mm.).
„ „ „ . . . . . 1 *Chaenophryne longiceps* (16 mm.).
2500 „ „ . . . . . 1 *Photocorynus spiniceps* (62 mm.).
„ „ „ . . . . . 2 *Dolopichthys heteracanthus* (30, 38 mm.).
„ „ „ . . . . . 2 *Chaenophryne longiceps* (20 mm.).
„ „ „ . . . . . 1 *Melanocetus niger* (37 mm.).
„ „ „ . . . . . 1 *Rhynchoceratias rostratus* (16 mm.).
2000 „ „ . . . . . 1 *Dolopichtys heteracanthus* (18 mm.).
„ „ „ . . . . . 1 *Melanocetus polyactis* (40 mm.).

St. 1217. Caribbean Sea, W. of Jamaica. (18° 50′ N. 79° 07′ W.).

4000 metres w. . . . . 1 *Lasiognathus saccostoma* (75 mm.).
„ „ „ . . . . . 3 *Melanocetus johnsoni* (15—35 mm.).
3000 „ „ . . . . . 1 *Dolopichthys megaceros* (15 mm.).
„ „ „ . . . . . 2 *Melanocetus johnsoni* (22, 32 mm.).
2500 „ „ . . . . . 1 *Gigantactis vanhoeffeni* (32 mm.).

St. 1228. Between Florida and Cuba. (23° 35′ N. 81° 54′ W.).

1000 metres w. . . . . 1 *Cryptosparas couesii* (22 mm.).

St. 1230. Between Florida and Cuba. (23° 13′ N. 82° 21′ W.).

1500 metres w. . . . . 1 *Cryptosparas couesii* (37 mm.).

St. 1239. N. E. Providence Str. Bahamas. (25° 50′ N. 76° 55′ W.).

3000 metres w. . . . . 1 *Rhynchoceratias oncorhynchus* (22 mm.).
2500 „ „ . . . . . 1 *Lophodolus acanthognathus* (12 mm.).
„ „ „ . . . . . 1 *Aceratias indicus* (23 mm.).

St. 1253. Caribbean Sea, near St. Croix. (17° 43′ N. 64° 56′ W.).

1000 metres w. . . . . 1 *Mancalias uranoscopus* (66 mm.).

St. 1256. Caribbean Sea, near St. Croix. (17° 43′ N. 64° 56′ W.).

1000 metres w. . . . . 1 *Dolopichthys megaceros* (36 mm.).

St. 1261. Atlantic, N. of Porto Rico. (19° 04′ N. 65° 43′ W.).
2500 metres w. ..... 1 *Rhynchoceratias leucorhinus* (18 mm.).
St. 1269. Caribbean Sea, S. of St. Croix. (17° 13′ N. 64° 58′ W.).
4500 metres w. ..... 1 *Melanocetus murrayi* (30 mm.).
„ „ „ ..... 1 *Mancalias uranoscopus* (56 mm.).
St. 1273. Caribbean Sea, near St. Croix. (17° 43′ N. 64° 56′ W.).
1200 metres w. ..... 1 *Dolopichthys megaceros* (22 mm.).
St. 1283. Caribbean Sea, W. of Martinique. (14° 38′ N. 61° 16′ W.).
4000 metres w. ..... 2 *Melanocetus murrayi* (60, 70 mm.).
St. 1322. Atlantic. (27° 02′ N. 53° 39′ W.).
2300 metres w. ..... 1 *Cryptosparas couesii* (15 mm.).
2000 „ „ ..... 1 *Himantolophus groenlandicus* (14 mm.).
1900 „ „ ..... 1 *Cryptosparas couesii* (14 mm.).
St. 1337. Atlantic. (29° 36° N. 64° 01′ W.).
1000 metres w. ..... 1 *Melanocetus johnsoni* (17 mm.).
St. 1339. Atlantic. (32° 00′ N. 64° 38′ W.).
1000 metres w. ..... 1 *Cryptosparas couesii* (17 mm.).
St. 1341. Atlantic. (33° 15′ N. 68° 20′ W.).
200 metres w. ..... 1 *Cryptosparas couesii* (28 mm.).
150 „ „ ..... 2 *Cryptosparas couesii* (20, 28 mm.).
St. 1342. Atlantic. (34° 00′ N. 70° 01′ W.).
4500 metres w. ..... 1 *Lophodolus acanthognathus* (22 mm.).
4000 „ „ ..... 1 *Melanocetus murrayi* (65 mm.),
3000 „ „ ..... 1 *Melanocetus johnsoni* (32 mm.).
„ „ „ ..... 1 *Cryptosparas couesii* (21 mm.).
St. 1345. Atlantic. (35° 07′ N. 72° 38′ W.).
300 metres w. ..... 1 *Cryptosparas couesii* (27 mm.).
St. 1353. Atlantic. (33° 51′ N. 66° 43′ W.).
200 metres w. ..... 1 *Cryptosparas couesii* (21 mm.).
St. 1356. Atlantic. (29° 56′ N. 59° 33′ W.).
1000 metres w. ..... 1 *Cryptosparas couesii* (26 mm.).
St. 1358. Atlantic. (28° 15′ N. 56° 00′ W.).
6000 metres w. ..... 1 *Rhynchoceratias brevirostris* (15 mm.).
4000 „ „ ..... 1 *Rhynchoceratias oncorhynchus* (21 mm.).
„ „ „ ..... 1 *Rhynchoceratias leucorhinus* (17 mm.).
3000 „ „ ..... 1 *Dolopichthys gracilispinis* (50 mm.).
„ „ „ ..... 1 *Lophodolus acanthognathus* (25 mm.).
„ „ „ ..... 2 *Cryptosparas couesii* (15, 24 mm.).
„ „ „ ..... 1 *Lipactis tumidus* (21 mm.).
„ „ „ ..... 1 *Aceratias indicus* (20 mm.).
„ „ „ ..... 1 *Rhynchoceratias leucorhinus* (22 mm.).
2000 „ „ ..... 3 *Cryptosparas couesii* (16—17 mm.).
St. 1365. Atlantic. (31° 47′ N. 41° 41′ W.).
5000 metres w. ..... 1 *Gigantactis macronema* (133 mm.).
4000 „ „ ..... 1 *Cryptosparas couesii* (17 mm.).
300 „ „ ..... 1 *Cryptosparas couesii* (17 mm.).

St. 1370. Atlantic. (36° 36′ N. 26° 14′ W.).

5000 metres	w.	1 *Melanocetus johnsoni* (20 mm.).
3000 „	„	1 *Dolopichthys megaceros* (21 mm.).
„	„	1 *Chaenophryne longiceps* (20 mm.).

4. GENERAL NOTES

With few exceptions the Lophioid and Antennarioid Pediculates are dwellers on the bottom in shallow or moderately deep water, but the Ceratioids are inhabitants of the deeper parts of the ocean, where they live in mid-water, the majority probably from about 500 to 1500 metres below the surface. The few large specimens (*Himantolophus, Ceratias, Cryptosparas*) that have been caught by trawl or line in comparatively shallow water may be regarded as stragglers, and it is not unlikely that it is the need for food which has led them to desert their normal habitat for regions where fish are more abundant and larger than they are in the middle depths of the ocean. SÆMUNDSSON's observation that a large *Ceratias* (1030 mm.), which was taken by a trawler to the south of Iceland at a depth of 120 metres, had in its stomach two full-grown specimens of *Gadus esmarkii*, newly swallowed, is of interest in this connection. A *Himantolophus* (360 mm. long) was taken by WOLFENDEN near Gibraltar at a depth of 35 fathoms (c. 64 metres) and a specimen of *H. appelii* of about the same size was captured on a line by fishermen at Port Nicholson, New Zealand; these are remarkable records for such fishes.

Beyond the fact that several species are known to have a very wide range little can be said as to the geographical distribution of the Ceratioids. Three specimens of *Caulophryne jordani* are known, one from the Gulf of Panama, one from the Atlantic, and one from the Indian Ocean; three specimens of *Haplophryne mollis* are known, one from the Atlantic, one from the Indian Ocean, and one taken to the north of New Zealand; in the face of such facts it would be unsafe to predict that any species would not turn up anywhere. Nevertheless there are indications that some species may have a more limited distribution; the "Dana" material suggests, for example, that the *Melanocetus* species of the Gulf of Panama are distinct from those of the Atlantic.

The characteristic features of the Ceratioids are evidently related to their conditions of life. As they inhabit a region where there is little or no light they show no trace of that gradation in colour from dark above to pale below which is seen in most fishes; the majority are uniformly blackish, but in two genera (*Edriolychnus, Haplophryne*) the skin is unpigmented. Also related to the absence of light is the structure of the bait, or terminal expansion of the illicium, which is a luminous bulb; the outer skin of the bulb is generally transparent and within is a glandular sac that opens to the exterior by a pore and has a luminous secretion; the lower, or sometimes the posterior part of the sac is pigmented, and this pigmented area, according to BRAUER, is covered inside by a layer of spindle-shaped cells which acts as a reflector. Externally the bulb may be furnished with papillae, flaps, filaments or tentacle-like appendages; in *Caulophryne* there appears to be no bulb, the illicium ending in a tassel of luminous filaments. There are great differences in the length of the line, or first dorsal ray; for example in *Edriolychnus* the luminous organ is sessile on the head, but in *Gigantactis macronema* it is borne on a line which is four times as long as the fish. This ray is articulated to the anterior end of a movable elongate basal bone, which as a rule lies in a trough on the upper surface of the head; in some genera the anterior end of the basal bone may project a little, and these lead to others in which the whole basal bone is completely and permanently exserted, and finally to such curious types as the Ceratiidae, in which the exserted basal bone is slender and flexible, $^1/_2$ to $^7/_8$ as long as the fish and much longer than the fin-ray. These fishes with exserted basal bone are true anglers, for they have both rod and line, and *Lasiognathus*, which is in addition provided with hooks, may well be termed a complete angler.

In most Ceratioids the spinous dorsal fin is represented by the illicium only, but when additional rays are present these seem generally to resemble the illicium at least to the extent of possessing a terminal gland with a pore; this is true of the Ceratiidae and of *Diceratias*, and perhaps of *Oneirodes*. It is very remarkable that in large examples of *Cryptosparas* the caudal rays may acquire a similar structure.

The skin may be either naked or spinulose; the spinules, when present, may either be close-set (*Ceratiidae*, *Gigantactinidae*) or scattered (*Himantolophidae*, *Aceratiidae*). The development of the spinules into large rounded bosses with a central spine in *Ceratias* and *Himantolophus* is an example of parallel evolution in two genera that are distinguished by their large size; these spiny plates have sometimes been described as horny (hence the name *Ceratias*) but they are formed of soft fibrous bone similar to that of other parts of the skeleton.

Brauer has described minute spinules in the skin of the illicium of a species of *Dolopichthys*, and it is probable that microscopic examination would show them to be present in most species in which the skin appears to be smooth and naked; three hook-shaped spines at the end of the illicium in *Lasiognathus* (a genus closely related to *Dolopichthys*) may perhaps be supposed to have developed from such minute spinules. In the *Aceratiidae* there is a remarkable modification of a series of spinules at the end of the snout; these become enlarged and fixed to the ethmoid cartilage; they project beyond the praemaxillaries and are hooked downwards at the ends to bite against the enlarged anterior teeth of the lower jaw.

The majority of the Ceratioids appear to be piscivorous, and have a large mouth and jaws furnished with slender acute teeth which are generally arranged in about three series, the largest teeth being the innermost; the teeth are depressible inwards, an arrangement that would make it very difficult for a Ceratioid to release a fish it had seized, even if it wanted to. Taking the dentition of *Melanocetus* as typical, *Ceratias* and *Linophryne* may be said to represent two extremes, the former having the teeth comparatively small and close-set, the latter having them very strong and set well apart. In some genera the stomach is extraordinarily distensible; thus a *Melanocetus* has been known to swallow a *Lampanyctus* three times its own length and many times its weight. I believe that two features diagnostic of the group, namely the reduced and toothless lower pharyngeals and the absence of pelvic fins, may be related to this distensibility.

Attention may here be directed to the Gigantactinidae, which from their form and the structure of their fins may be judged to be more active swimmers than the rest, to *Lasiognathus*, with its peculiar pouch-like mouth bordered with bristle-shaped teeth, to the presence of a hyoid barbel in *Linophryne* and its remarkable modifications in the four known species, and finally to two families, Neoceratiidae and Aceratidae, that have lost the illicium and, having to seek their prey instead of waiting for it to come to them, have the olfactory organs much better developed than in other members of the group. *Neoceratias*, with teeth on top of the head that recall the spines of an Echinoid, is perhaps the strangest of all the Ceratioids; of the Aceratiidae, *Rhynchoceratias* is remarkable for its pincer-like jaws and *Aceratias* for the forwardly-directed telescopic eyes, indicating that the fishes of this genus have binocular vision.

The extraordinary diversity of the Ceratioids calls to mind a passage in the Origin of Species (Ed. VI, p. 81). — "The more diversified the descendants from any one species become in structure, constitution and habits, by so much will they be better able to seize on many and widely diversified places in the polity of nature, and so be able to increase in numbers." At present we do not know certainly for any one species its vertical or horizontal distribution, the conditions most favourable for its existence, or the nature of its food; but we may be certain that these are different for the different species and that the differences in form, in the structure of the fins, in the size and shape of the mouth, in the dentition, and in the structure of the illicium, are related to different habits.

5. DWARFED MALES

The Ceratioids are unique among Vertebrates in having the males dwarfed and parasitic on the females (REGAN, Proc. R. Soc., B. XCVII, 1925, p. 386). I believe that males of this kind are characteristic of the group, my reasons being that I have found them in three very distinct families and that I have examined a considerable number of free-swimming fish, all of which have proved to be females. The rarity of the males is somewhat surprising; although a large proportion of the known Ceratioids are young examples, to which one might not expect to find males attached, the number of females with males (four) is very small in comparison with those without them.

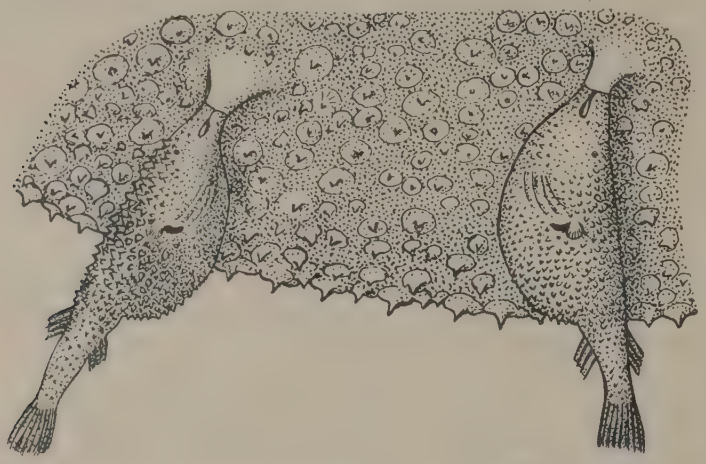

Fig. 1. Two males of *Ceratias holboelli*; 3/4 natural size. After SÆMUNDSSON.

The species in which males are known are *Photocorynus spiniceps* (♂ 10 mm. long attached to a ♀ of 62 mm.), *Edriolychnus schmidti* (♂ 14 mm. long attached to a ♀ of 62 mm.) and *Ceratias holboelli* (♂s of 80 and 85 mm. on a ♀ of 1030 mm., and ♂ of 105 mm. on a ♀ of 1000 mm.). The males have a general resemblance to the females in form, but differ from them in the development of structures for attachment, in the absence of the illicium (and of other rays of the spinous dorsal when these are developed in the female) the reduction or absence of spines on the head, when these are present in the female, the absence of teeth, and the vestigial condition of the gut; the only organ of importance in the abdominal cavity is the large testis (figs. 3, 5).

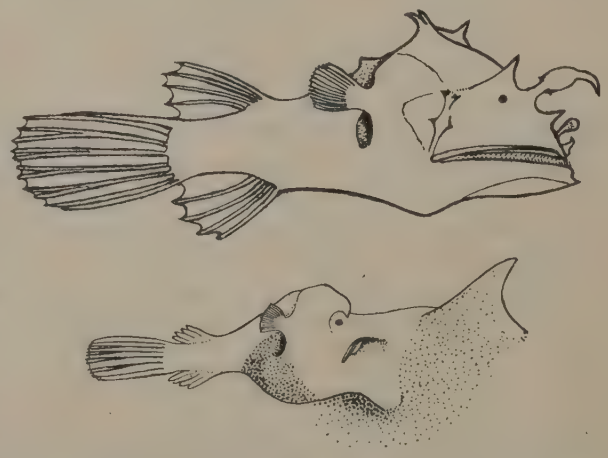

Fig. 2. *Photocorynus spiniceps*, Regan, female with male attached (× 1 1/3), and below: male, attached to head of female in front of right supraorbital spine (× 5 1/3). From REGAN, Proc. R. Soc. 1925.

The method of attachment to the female is of considerable interest. In *Photocorynus* and *Ceratias* upper and lower outgrowths of the anterior end of the head of the male unite in front of the mouth and fuse with a papilla-like projection from the skin of the female. The outer skin of the two fishes is continuous, so that it is impossible to say exactly where one begins and the other ends; microscopic examination of sections of a strip of the tissue connecting the male and female *Ceratias* shows that the male and female are completely blended, the highly vascular fibrous tissue of the outgrowths of the male being continuous with that of the papilla of the female; in both the general direction of the fibres and of the small blood-vessels is longitudinal, i. e. leading from one fish to the other, and it seems almost certain that the blood-systems of the two fishes are continuous and that the male is nourished by the female. It has been suggested to me that the attachment

may be of the nature of a placenta; it would be rather difficult to disprove this, but I think it unlikely, for a placenta is essentially an attachment between two animals that separate later on; but when the attachment is permanent such a complication is unnecessary and need not be expected.

In the largest male *Ceratias* (105 mm.) I described a swollen ring of tissue at the anterior end of the outgrowths, encircling the papilla of the female. Dissection showed that this tissue was black and had the form of a cup with thickened rim, and microscopic examination showed that it was distinguished by the greater branching of the small blood-vessels and the presence of pigment granules. I am inclined to regard the development of this pigmented tissue as related to the large size of this male, and to think that it is not an essential feature of the connection.

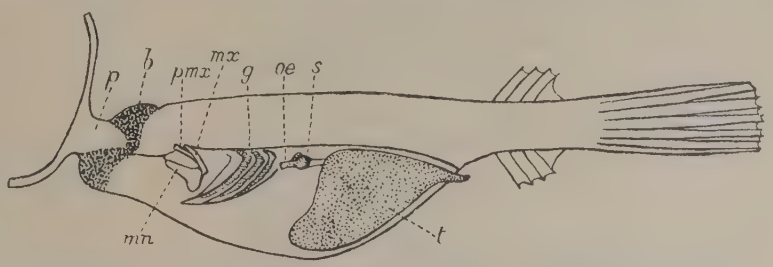

Fig. 3. *Ceratias holboelli*, male; diagram illustrating the principal organs; the region in front of the mouth shown in median longitudinal section. *b*, "black tissue"; *g*, gills; *mn*, lower jaw; *mx*, maxillary; *œ*, æsophagus; *p*, papilla of female; *pmx*, præmaxillary; *s*, stomach; *t*, testis. From Regan, Proc. R. Soc. 1925.

Before I discovered *Edriolychnus* I suggested that the males must become attached to the females very early, probably at the end of their larval life, and that the first attachment must be by the mouth,

Fig. 4. *Ceratias holboelli*, female with male attached; 1/6 natural size. From Regan, Proc. R. Soc. 1925.

the jaws nipping a piece of the skin of the female and forming a papilla; this would be followed by fusion of the lips with the skin of the papilla, and later by the development of outgrowths which separated the mouth from the papilla. *Edriolychnus* confirmed this, but I found it difficult to understand why the male of this genus should become adult when the attachment was of so primitive a type, the jaws still embracing the papilla of the female (Fig. 5, p. 14). Subsequent reflection, followed by reexamination of the specimens, has elucidated the matter. In the Ceratioids there is a large tongue supported by the basi-hyal; it is freely movable and can be pressed upwards against the roof of the mouth or thrust downwards and forwards, distending the skin between the rami of the lower jaw. After the first attachment of the male two alternatives appear to be possible; either the tongue may fuse with the papilla of the female inside the mouth, or it may protrude forwards between the rami of the lower jaw and establish a connection with the papilla outside the mouth. The first method has been adopted by *Edriolychnus*, the second by *Photocorynus* and *Ceratias*. The second method has the advantage that by subsequent growth the whole mouth

may be set free for purposes of respiration, whereas the male *Edriolychnus* must always have its mouth choked up, with only a tiny opening at the corner for the intake of the respiratory current. In both types there is a connection above the mouth between the snout of the male and the papilla of the female.

The male has a well-developed heart and gills, so that it does not depend on the blood of the female for oxygen, but only for nutritive materials. The small capillary-like vessels of the tissue connecting the two fishes receive arterial blood from both, and veins from them run to both fishes; the regulation of such a system so as to permit an interchange of blood would not seem to be a difficult matter.

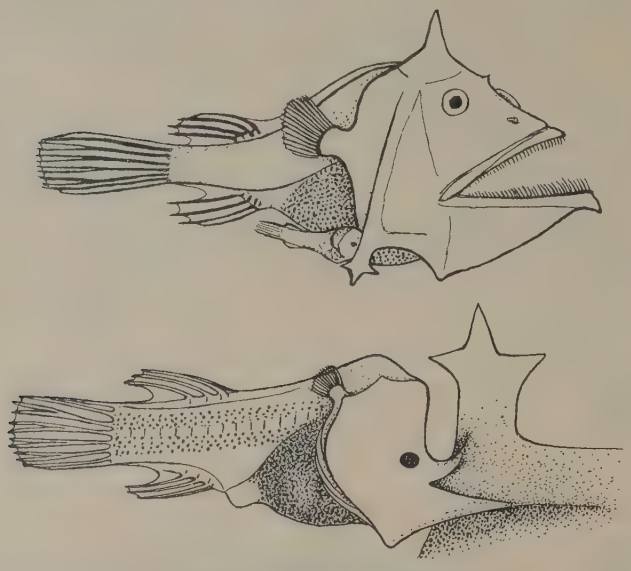

Fig. 5. *Edriolychnus schmidti*, Regan, female with male attached (× 1⅓), and below: male, attached to inner face of præoperculum of female (× 5). The pigmented organ behind the head of the male is the testis. From Regan, Proc. R. Soc. 1925.

The reason why the Ceratioids, alone amongst Vertebrates, have males of this kind is evident. They are necessarily few in numbers in comparison with the more active fishes on which they prey, and they lead a solitary life, floating about in the darkness of the middle depths of the ocean. Under such circumstances it would be very difficult for a mature fish to find a mate, but this difficulty appears to some extent to have been got over by the males, soon after they are hatched, when they are relatively numerous, attaching themselves to the females, if they are fortunate enough to meet them, and remaining attached throughout life. In all probability the males are incapable of free development, and it is likely that the great majority of them fail to find a female and perish, although another possibility has been suggested to me, namely, that the post-larval fish that find and become attached to females develop into males, and those that do not into females.

The evolution of dwarfed males, parasitic on the females, in the Ceratioids, thus becomes intelligible when considered in relation to the habits of these fishes and their conditions of life. In view of modern criticisms of evolutionary theories one may ask whether it would become more intelligible if it were possible to catch these fishes in numbers, to keep them alive, and to experiment with them. If, as the result of experiments, we were informed that the factors for dwarfness, vestigial gut and absence of teeth were carried by the same chromosome as the factor for maleness, or that the development of the testis depended on a hormone secreted by the ovary, should we know any more than we do now? To me it would be obvious that such relations, if they existed, were secondary, and had no bearing on the problems of origin.

6. OSTEOLOGY AND CLASSIFICATION

In a former paper on the classification of the *Pediculati* (Ann. Mag. Nat. Hist. (8) IX, 1912). I was able to show that the cranial structure of *Melanocetus* is quite different from that of either *Ceratias* or of *Himantolophus* and *Diceratias*; thus three families of Ceratioids, Melanocetidae, Ceratiidae and Himantolophidae, were defined by cranial characters. I then included in the Himantolophidae three genera that I had not seen, *Oneirodes*, *Dolopichthys* and *Linophryne*; the "Dana" material has revealed that none of these

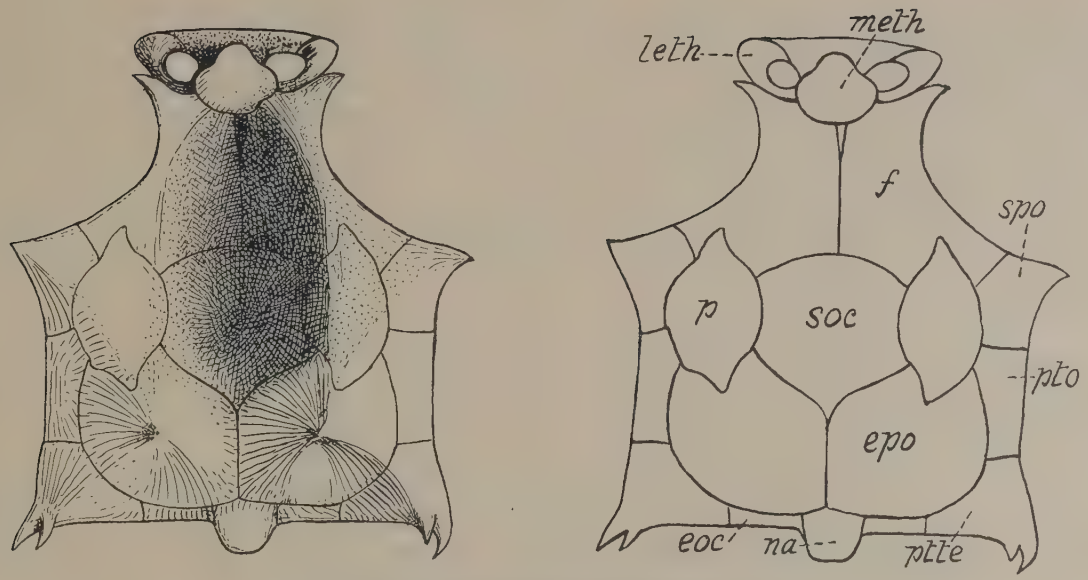

Fig. 6. Skull of *Photocorynus spiniceps*, Regan. (× 3).

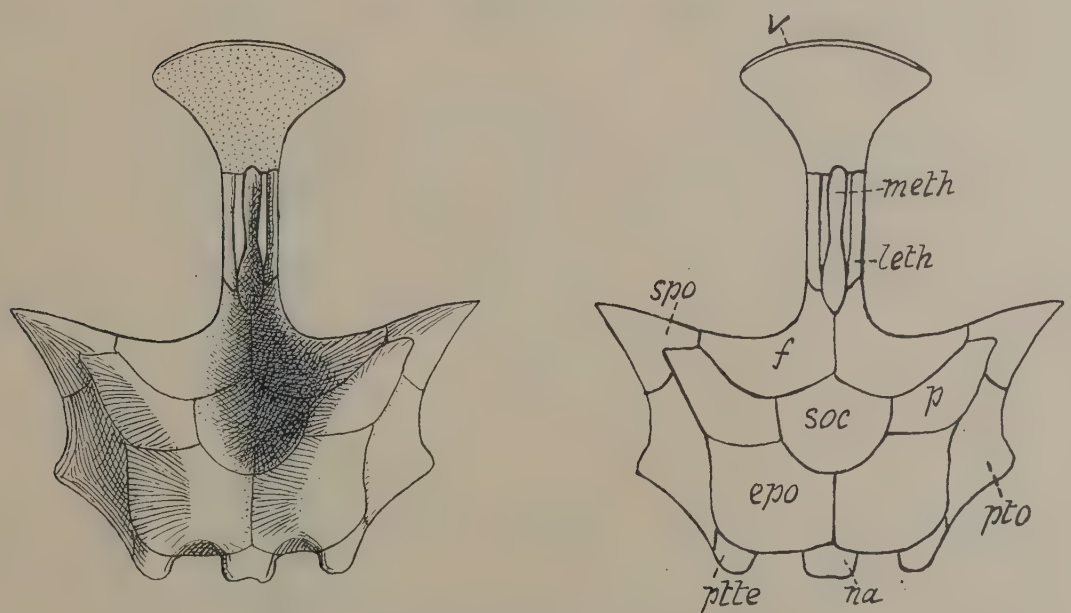

Fig. 7. Skull of *Caulophryne jordani*, Goode a Bean. (× 5).

Abbreviations used in figs. 6 to 15.

c	cartilage.	*p*	parietal.
eoc	exoccipital.	*pto*	pterotic.
epo	epiotic.	*ptte*	post-temporal.
f	frontal.	*r*	rostral denticles.
leth	lateral ethmoid.	*soc*	supraoccipital.
meth	mesethmoid.	*spo*	sphenotic.
na	neural arch of first vertebra.	*v*	vomer.

belongs to the Himantolophidae, and that *Oneirodes* and *Dolopichthys* have one type of skull and *Linophryne* another. Moreover the "Dana" collection has shown that the Caulophrynidae, Gigantactinidae and Ceratiidae, families formerly defined by external characters only, are well distinguished by cranial differences. Finally, an examination of the skull of the new genus *Photocorynus* shows it to be the type of a well-marked family. Thus nine families of Ceratioids can now be defined by osteological characters, and a tenth may be added to include the aberrant *Neoceratias*, described by Pappenheim in 1914.

I have not examined a complete skeleton of any genus and my study of the cranial osteology has been confined mainly to the upper surface of the skull. My aim has been to do as little damage as possible: generally I made an incision in the skin and folded it back, and then cut through the attachments of the basal bone of the illicium.[1]

Owing to the small size of many of the specimens, the preservation in formalin, the weakness of the ossification, and the firmness of the attachment of the tendons and muscles of the basal bone, the study has been one of some difficulty; but it has been of great interest, revealing an extraordinary diversity of structure within the limits of the group.

The skulls examined show no exceptions to the characters I have given previously as diagnostic of the *Pediculati*, namely that the parietals, when present, are separated by the supraoccipital, that the epiotics meet behind the supraoccipital, that orbitosphenoid, basisphenoid and opisthotics are absent, that the post-temporal forms an integral part of the skull, being united by suture to the epiotic and pterotic, and that the first vertebra is rigidly attached to the basioccipital and exoccipitals. One feature alone appears constantly to distinguish the skull of the Ceratioids from that of the Lophioids and Antennarioids, namely the inclusion of the supraoccipital in the trough in which the basal bone of the illicium lies or is attached.

The skull of *Photocorynus* (fig. 6, p. 15) is less specialized than that of any other Ceratioid, and more nearly approaches that of *Lophius* in essentials. The frontals meet in the middle line and, with the supraoccipital, form the floor and sides of a broad trough; the epiotics are large and prominent; the ethmoid region is short; the great width of the postorbital part of the skull and the strong spines of the post-temporals, epiotics, sphenotics and frontals are notable.

The skull of *Caulophryne* (fig. 7, p. 15) is small for the size of the fish; consequently, as the mouth is large, the suspensorium is directed obliquely backwards. Behind the ethmoid region the skull is not unlike that of *Photocorynus*, except for the expansion of the sphenotics and pterotics, due to the relatively larger size of the head of the hyomandibular. The ethmoid region is quite different from that of *Photocorynus*, being long and narrow, with the slender and parallel lateral ethmoids bordering a groove, the floor of which is formed by the mesethmoid; in this groove lies the anterior part of the basal bone of the illicium.

Of the Linophrynidae I have studied especially *Borophryne* (fig. 8), but I have ascertained that *Linophryne*, *Edriolychnus*, and *Haplophryne* are essentially similar. The skull differs from that of the Photocorynidae especially in the complete separation of the frontal bones, exposing the parasphenoid. The praeoperculum differs from that of all other Ceratioids; it is angular, generally with a spine at the angle, and is attached at its upper and lower ends only, instead of throughout its length.

In the Oneirodidae, of which I have examined especially *Oneirodes* (fig. 9) and *Dolopichthys*, the skull is longer and more compressed than in *Photocorynus*, and the trough on its upper surface extends right back to its posterior end. Between the supraoccipital and the mesethmoid the floor of this trough is formed by a long tract of cartilage, with a vacuity on each side immediately in front of the supraoccipital. The frontals appear to be completely separated, but it is difficult to determine whether the cartilage in front of the vacuities is covered by an unossified membrane or by delicate and scarcely ossified laminae projecting

[1] Frequently, the specimen to be examined was determined by the condition of preservation, the loose skin being ruptured and partly torn off in some examples, probably by their struggles in the nets.

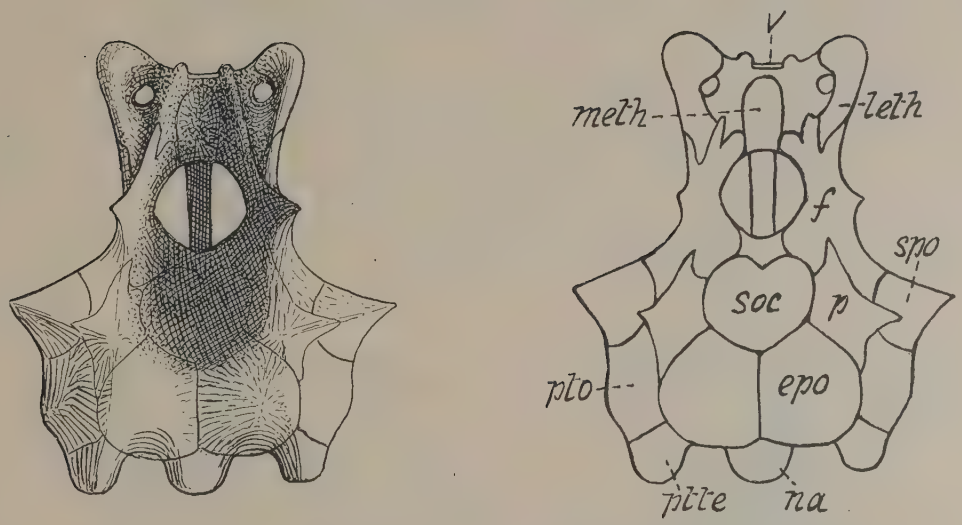

Fig. 8. Skull of *Borophryne apogon*, Regan. (× 3).

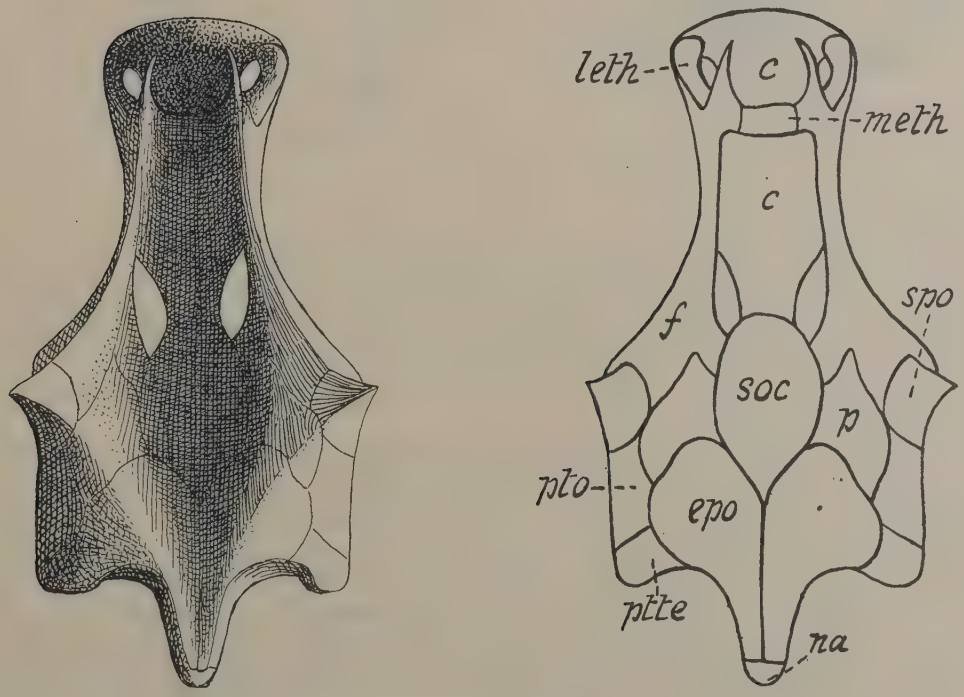

Fig. 9 Skull of *Oneirodes eschrichtii*, Lütken. (× 1½).

downwards and inwards from the frontals. The slender spines, projecting forwards on each side of the mesethmoid, appear to be formed by the lateral ethmoids below and the frontals above; they serve to limit the movements of the praemaxillary pedicels, which, when retracted, abut against the vertical anterior face of the mesethmoid.

Melanocetus (fig. 10) is evidently related to the Oneirodidæ. The skull is much broader; the cartilaginous tract between the supraoccipital and the mesethmoid is quite short; the frontals are triradiate bones, one limb forming the lateral margin of the interorbital part of the cranial trough, the second running downwards, forwards and outwards above the lateral ethmoid, the third running downwards and inwards to the mesethmoid. The large vacuities between mesethmoid and lateral ethmoids are separated from those of the interorbital region by the inner limbs of the frontals.

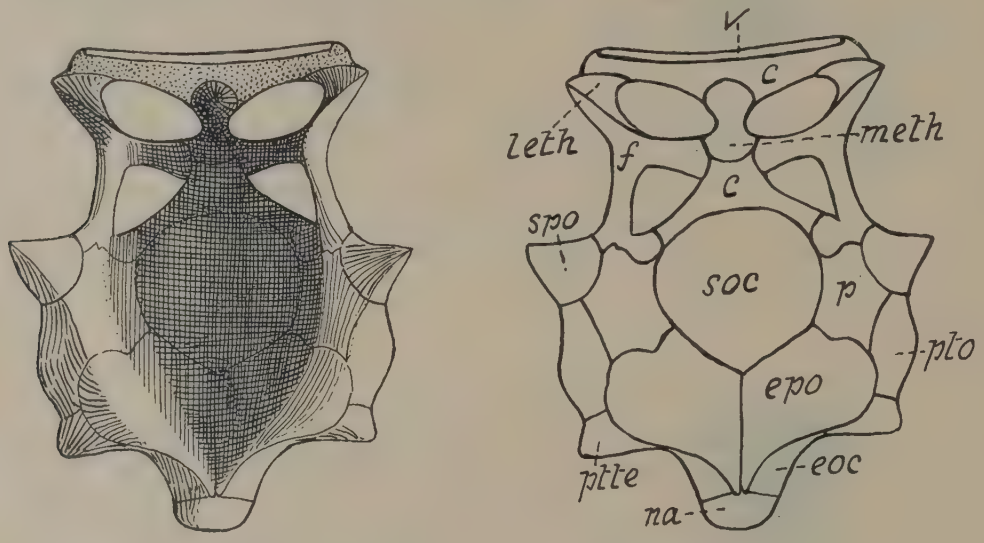

Fig. 10. Skull of *Melanocetus johnsoni*, Günther. (× 3).

The skull of *Cryptosparas couesii* (fig. 11) is essentially similar to that of *Ceratias* as described by LÜTKEN (Vidensk. Selsk. Skr. (8) XI, 1878) and shows certain resemblances to that of the Oneirodidae. The most important difference is that the trough on the upper surface gradually deepens backwards and tends to become roofed over by the parietals and epiotics; at the posterior end the epiotics nearly or quite meet in the middle line above it. In the interorbital region laminae of the frontals meet in the middle line and cover the cartilage in front of the vacuities.

The skull of *Gigantactis* (fig. 12) is particularly difficult to investigate. It is small, and the removal of the attachments of the relatively large basal bone can hardly be accomplished without distorting its shape and displacing the bones; consequently my figure is to some extent a restoration. The partial roofing over of the trough in the postorbital part of the skull recalls the Ceratiidae, but the resemblance ends there. In front of their junction with the parietals the frontals suddenly dip, and after running forward a short distance rise again to join the lateral ethmoids; from these anterior elevations laminae run downwards and inwards to the mesethmoid, and posteriorly laminae run inwards to meet in front of the supraoccipital. The large lateral ethmoids are elevated posteriorly and run obliquely downwards and forwards to the cartilage below the mesethmoid. The mesethmoid is very long and projects anteriorly. There can be no doubt that the peculiarities of the ethmoid region are due to the terminal position of the illicium and the large size of its basal bone.

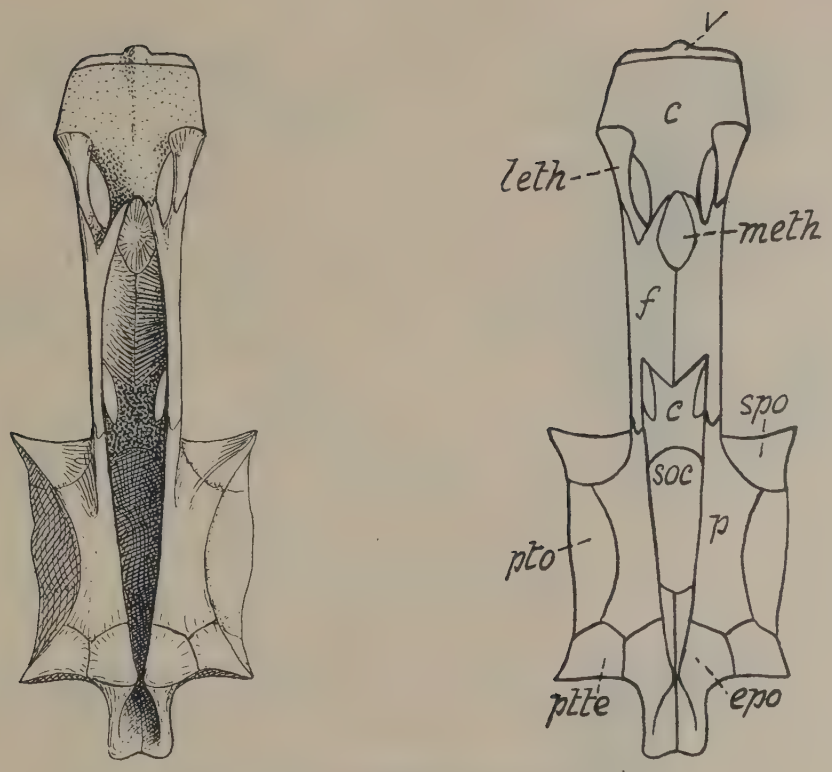

Fig. 11. Skull of *Cryptosparas couesii*, Gill. (× 1^{1} $_{2}$).

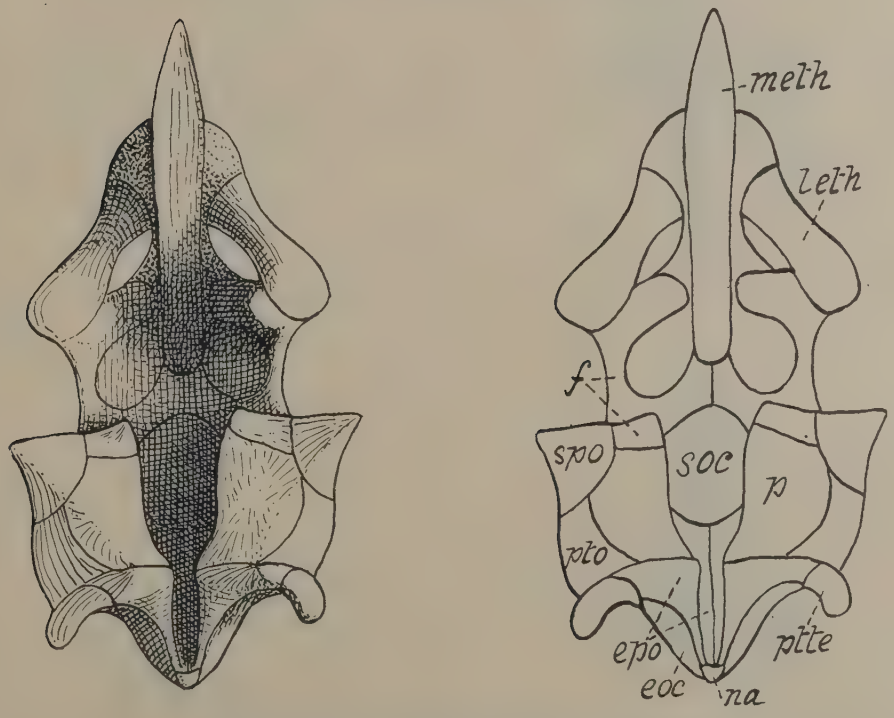

Fig. 12. Skull of *Gigantactis gracilicauda*, Regan. (× 5).

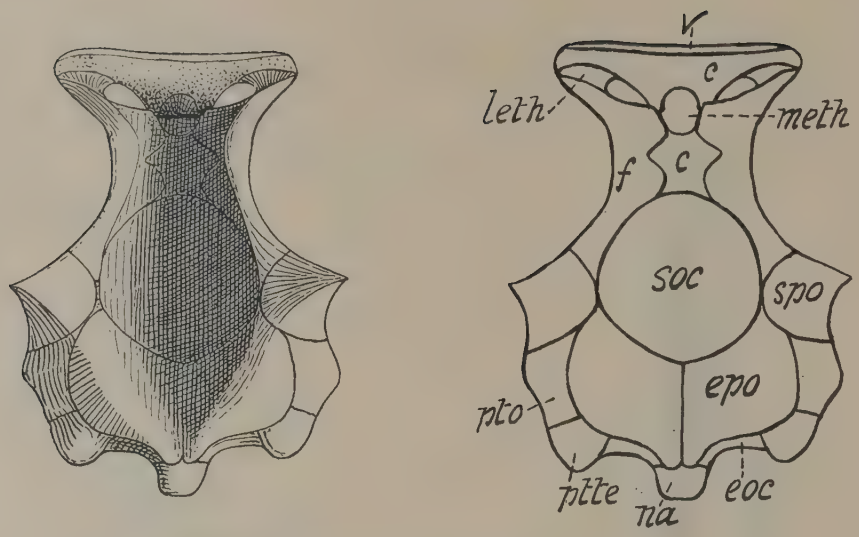

Fig. 13. Skull of *Diceratias bispinosus*, Günther. (× 2).

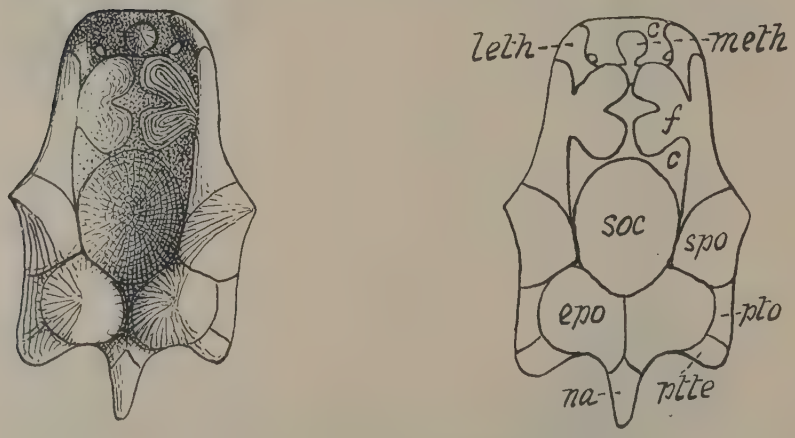

Fig. 14. Skull of *Lipactis tumidus*, Regan. (× 5).

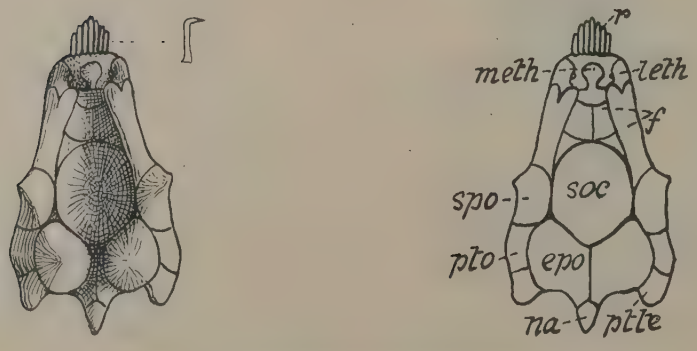

Fig. 15. Skull of *Rhynchoceratias oncorhynchus*, Regan. (× 4).

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Diceratias (fig. 13) is essentially similar to *Himantolophus* as described by LÜTKEN (Vidensk. Selsk. Skr. (6) IV, 1887). In the shape and extent of the cranial trough these genera resemble the Oneirodidae; the distinctive features of the skull are the large size of the supraoccipital and the absence of the parietals. There are no vacuities in the interorbital region.

Lipactis (fig. 14) has a considerable resemblance to a young Himantolophid, and that this is due to relationship is confirmed by the cranial structure. The principal differences are that the trough on the upper surface is shallow and is reduced to a mere groove between the epiotics, and that the basal bone of the illicium is fixed, its anterior end being attached to the mesethmoid. *Rhynchoceratias* (fig. 15) is very similar to *Lipactis*; the rostral denticles are fixed to the ethmoid cartilage.

7. SYSTEMATIC REVISION OF THE CERATIOIDEA

Order **PEDICULATI**

Highly specialized fishes derived from the Percomorphi, with the first ray of the spinous dorsal fin placed on the head and modified into a line and bait. Gill-openings restricted. Parietals, when present, separated by supraoccipital; epiotics meeting behind supraoccipital; orbitosphenoid, basisphenoid and opisthotics absent. First vertebra rigidly attached to skull; no ribs and no epipleurals; hypurals a pair of plates, or one only, ankylosed to last centrum. Post-temporal short, simple, suturally united to epiotic and pterotic, and sometimes to parietal and exoccipital; supra-cleithrum elongate: post-cleithrum single; hypercoracoid and hypocoracoid small; pectoral radials elongate, 2 or 3 in number, lowest expanded distally.

Sub-order **CERATIOIDEA**

Illicium (first ray of dorsal fin) generally ending in a luminous bulb. Pelvic fins absent. Gill openings below base of pectorals. Lower pharyngeals reduced, toothless. Gills generally absent from first arch (rarely a small hemibranch), complete on second and third, reduced to a hemibranch on fourth. Supraoccipital forming a considerable part of floor of trough on the upper surface of skull.

Family 1. PHOTOCORYNIDAE

Skull broad, somewhat contracted anteriorly; ethmoidal region short; trough on upper surface of skull not extending to epiotics; parietals present; frontals meeting in front of supraoccipital; praeoperculum attached throughout its length; three pectoral radials.

1. **PHOTOCORYNUS,** Regan 1925.

Proc. R. S., B, XCVII, p. 394.

Praemaxillaries protractile; maxillaries slender. Mouth large, nearly horizontal; teeth moderate, slender, unequal, acute, depressible. Illicium supra-rostral; dorsal and anal short; caudal with 4 bifid rays. Skin naked, blackish.

1. PHOTOCORYNUS SPINICEPS, Regan 1925.

(Textfigure 2, p. 12; Plate I, fig. 1).

Proc. R. S., B, XCVII, p. 394, figs. 6, 7.

D. 4; A. 4. Form moderately elongate. Head large; interorbital width about $^1/_2$ postorbital width; strong spines on epiotics and sphenotics, and at anterior ends of frontals; a bifid spine on post-temporal;

praemaxillary pedicels bearing a spine; a spine at anterior end of maxillary; praeoperculum with alternating paired and unpaired spines. Illicium near end of snout, small, simple, club-shaped.

Gulf of Panama.

Two specimens, 62 (46 + 16) and 50 mm. long, from Station 1209, with 2500 and 3500 metres of wire out.

The larger specimen is the type; it has a male 10 mm. long attached to the top of the head above the right eye.

Family 2. CAULOPHRYNIDAE

Skull much expanded behind and narrowed between orbits; mesethmoid and lateral ethmoids long, slender, parallel; palatine hammer-shaped, with a long head running transversely from anterior end of lateral ethmoid to articulation of maxillary. Trough on upper surface of skull not extending to epiotics; parietals present; frontals meeting in front of supraoccipital; praeoperculum attached throughout its length; two pectoral radials.

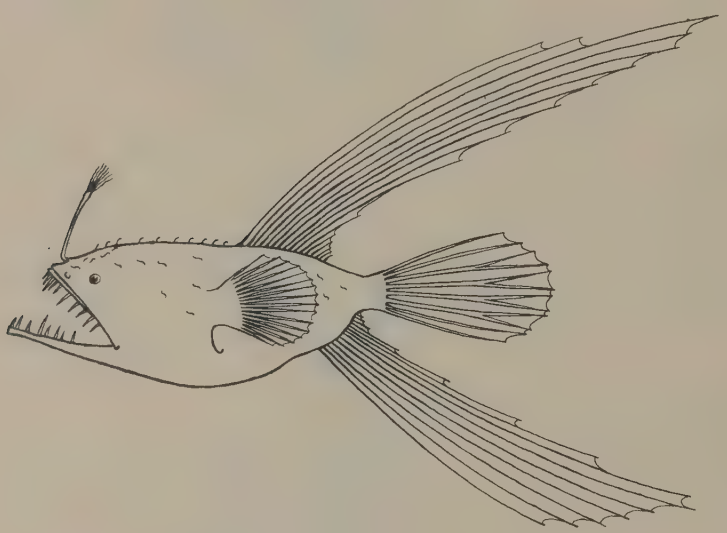


Fig. 16. *Caulophryne jordani*, Goode & Bean. After Goode & Bean 1896.

1. **CAULOPHRYNE,** Goode and Bean 1896.

Bull. Mus. Comp. Zool. XXII, p. 496.

Praemaxillaries a little protractile; maxillaries slender. Mouth wide, little oblique; teeth rather strong, unequal, slender, acute, depressible; two teeth on vomer. Illicium supra-rostral; dorsal and anal rather long; caudal with 4 bifid rays; rays of dorsal, anal and caudal much produced.

The filaments on the head and body appear to be elongate papillae of the lateral line. In most Ceratioids the lateral line appears externally as a series of pores, but in some genera these pores are borne on distinct papillae.

1. CAULOPHRYNE JORDANI, Goode & Bean 1896.

(Textfigure 16).

Bull. Mus. Comp. Zool. XXII, p. 496, fig. 409; Jordan & Evermann, Bull. U. S. Nat. Mus. XLVII, 1898, p. 2735, fig. 957.

D. 15; A. 14; P. 18—19. Illicium about $^1/_2$ length of fish (without caudal), the last $^1/_3$ of its length occupied by a tassel of about 8 white filaments; no bulb.

A specimen 90 (60 + 30) mm. in total length, from the Gulf of Panama (Station 1209, 3500 metres of wire out) agrees closely with the figure of the type, a specimen of about 40 (27 + 13) mm., taken off Carolina. The principal difference is that in the type the illicium is shorter, partly because the terminal filaments are broken, and in all probability partly on account of the smaller size of the fish; the number of fin-rays in the type is given as D. 16; A. 14; P. 16.

Melanocetus pelagicus, Brauer ("Valdivia" Tiefsee-Fische, p. 321, pl. XV, fig. 5) based on a specimen from the Indian Ocean only 16 (11 + 5) mm. long, is probably a synonym of *C. jordani*. The number of fin rays is given as D. 13; A. 11; P. 20; but the last 2 or 3 rays of the dorsal and anal, which are short, may have been overlooked.

Family 3. LINOPHRYNIDAE

Trough on upper surface of skull not extending to epiotics; parietals present; frontals separated; praeoperculum attached at the ends only, angular, generally with a spine at the angle; three pectoral radials. Praemaxillaries a little protractile; maxillaries slender. Mouth little oblique; teeth acute, depressible. Illicium supra-rostral; dorsal and anal short; caudal with 4 bifid rays.

Synopsis of the Genera.

1. Skin blackish; teeth few and very strong.
   - No barbel; no praeopercular spine ..... 1. *Acentrophryne*
   - No barbel; a praeopercular spine ..... 2. *Borophryne*
   - A hyoid barbel; a praeopercular spine ..... 3. *Linophryne*
2. Skin translucent; teeth moderate.
   - Illicium a large bulb sessile on upper surface of snout; praeopercular spine strong, trifid ..... 4. *Edriolychnus*
   - Illicium small, subcutaneous, not projecting; praeopercular spine simple, concealed beneath the skin ..... 5. *Haplophryne*

1. ACENTROPHRYNE, gen. n.

Skin blackish; teeth few and very strong. No barbel. Praeoperculum rounded at angle, without spine.

1. ACENTROPHRYNE LONGIDENS, sp. n.

(Plate I, fig. 2).

D. 4; A. 4; P. 18. Mouth large; lower jaw $^3/_5$ length of fish (snout to base of caudal). Illicium $^3/_5$ length of fish, with rather stout white stem, ovate bulb and short terminal appendage.

Gulf of Panama; Station 1203, 2500 metres of wire out.

A single specimen, 75 (50 + 25) mm. in total length.

In form, size of the mouth, dentition, and structure of the illicium, this fish more nearly resembles *Linophryne macrodon* than *Borophryne apogon*.

2. BOROPHRYNE, Regan 1925.

Ann. Mag. Nat. Hist. (9) XV, p. 564.

As *Linophryne*, but without a barbel.

1. BOROPHRYNE APOGON, Regan 1925.

(Plate II, fig. 1).

D. 4; A. 4; P. 15—16. Form rather deep; gill-opening about in the middle of the length. Mouth slightly oblique; principal teeth in jaws very long, set well apart; two teeth on vomer. Illicium near end of snout, with short black stem and luminous bulb; latter with a bifid appendage at end and with numerous branched filaments at the sides. Four specimens, 40 (28 + 12) to 83 (65 + 18) mm. in total length, from the Gulf of Panama; three from Station 1209, 7° 15′ N. 78° 54′ W., 3500 metres of wire out, and one from Station 1208, 6° 48′ N. 80° 33′ W., 3500 metres of wire out.

3. LINOPHRYNE, Collett 1886.

Proc. Zool. Soc. 1886, p. 138.

Strong sphenotic spines. Mouth large; teeth in jaws in 2 or 3 series, the inner few in number, very long, and set well apart; a pair of teeth on the vomer. Illicium near end of snout, with stem and

bulb; basal bone not or but little exserted. A well-developed hyoid barbel, bifid or branched, the ultimate branches with papillae. Skin blackish. Praeopercular spine strong, simple.

The four species differ from each other especially in the structure of the illicium and of the barbel. The papillae of the barbel are presumably sensory, perhaps tactile.

1. LINOPHRYNE LUCIFER, Collett 1886.

Proc. Zool. Soc. 1886, p. 138, pl. XV. Goode and Bean, Bull. Mus. Comp. Zool. XXII, 1896, p. 496, pl. CXXI fig. 408.

D. 3; A. 2; P. 14—15. Illicium about $^1/_4$ length of fish to base of caudal, with stout stem about as long as the large ovate bulb, and with small terminal filament. Barbel $^2/_3$ length of fish, bifid.

Known from a single specimen, 49 mm. in total length, from the Atlantic, 36° N. 20° W., captured at the surface, alive but helpless, having swallowed a fish much larger than itself.

2. LINOPHRYNE MACRODON, Regan 1925.

(Plate II, fig. 2).

Ann. Mag. Nat. Hist. (9) XV, p. 564.

D. 3; A. 3; P. 17. Illicium $^2/_5$ length of fish, longer and more slender than in *L. lucifer*, with smaller bulb and longer terminal filament. Barbel $^2/_3$ length of fish, bearing a lateral branch before it bifurcates; each terminal branch dividing into two long filaments, each of which bears shorter ones.

A single specimen, 53 (38 + 15) mm. in total length, from the Gulf of Panama, Station 1208, 6° 48′ N. 80° 33′ W., 3500 metres of wire out.

3. LINOPHRYNE ARBORIFER, Regan 1925.

(Plate III, fig. 1).

Ann. Mag. Nat. Hist. (9) XV, p. 564.

D. 3; A. 3; P. 16. Illicium more than $^1/_2$ length of fish, with stem slightly longer than bulb and trifid terminal appendage longer than both together. Barbel as long as fish, much branched, the ultimate branches being filamentous.

A single specimen, 70 (50 + 20) mm. in total length, from the Atlantic, Station 1161, 14° 52′ N. 28° 04′ W., 600 metres of wire out.

4. LINOPHRYNE POLYPOGON, Regan 1925.

(Plate II, fig. 3).

Ann. Mag. Nat. Hist. (9) XV, p. 565.

D. 3; A. 3; P. 12. Illicium a little more than $^1/_3$ length of fish; stem twice as long as bulb, which has a series of filaments on each side. Barbel $^1/_2$ length of fish, with about 16 equal slender branches arising together from the very short basal part.

A single specimen, 45 (32 + 13) mm. in total length, from the Atlantic, Station 1142, 32° 26′ N. 16° 59′ W., 5000 metres of wire out.

4. EDRIOLYCHNUS, Regan 1925.

Proc. R. Soc., B, XCVII, p. 398.

Sphenotic spines strong. Mouth large; teeth in jaws moderate, unequal, in 2 or 3 series anteriorly; palate toothless. Illicium represented by a luminous organ sessile on the upper surface of the snout. No barbel. Praeopercular spine trifid. Skin translucent, without or with little pigment.

A single species.

1. EDRIOLYCHNUS SCHMIDTI, Regan 1925.

(Textfigure 5, p. 14; Plate III, fig. 2).

Proc. R. Soc., B, XCVII, p. 398, figs. 8, 9.

D. 4; A. 4; P. 15—16. Illicium represented by a rather large luminous organ on the upper surface of the snout, circular and somewhat depressed, with inner sac, pigmented below and white above, enclosed in a translucent skin.

The type, 63 (48 + 15) mm. in total length, is from the Caribbean Sea, Station 1183, 13° 47′ N. 61° 26′ W., 4500 metres of wire out. A second specimen, 53 (40 + 13) mm. long, is from the Gulf of Panama, Station 1203, 7° 30′ N. 79° 19′ W., 3500 metres of wire out, and a third, 35 mm. long, is from the Atlantic, Station 1156, 25° 11′ N. 20° 57′ W., 6000 metres of wire out.

The type has the interest that it is a mature female and has an adult male 14 (10 + 4) mm. long attached to the inner face of the praeoperculum beneath the spine. The male has no illicium, no spines on the head and no teeth; a large testis occupies the abdominal cavity.

The skin of the male and female are continuous; within the mouth of the male is a mass of tissue that appears to be formed by the fusion of the tongue of the male with a papilla-like outgrowth of the female; above the mouth a band of tissue extends forward from the interorbital region of the male to unite with the papilla of the female; the lower jaw of the male is covered with thin skin, which unites anteriorly with that of the lower part of the papilla.

5. HAPLOPHRYNE, Regan 1912.

Ann. Mag. Nat. Hist. (8) IX, p. 289.

Sphenotic spines not prominent. Mouth rather small; teeth moderate. Illicium subcutaneous, small, with short stem and terminal bulb; a pore on upper surface of snout, at the margin of which the skin is attached to distal end of illicium. No barbel. Praeopercular spine simple, concealed beneath the skin. Skin thin, loose, translucent, unpigmented.

1. HAPLOPHRYNE MOLLIS, Brauer 1902.

(Plate III, fig. 3).

Aceratias mollis, Brauer, "Valdivia" Tiefsee-Fische, p. 324, pl. XVI, fig. 10 (1906).

Haplophryne mollis, Regan, Ann. Mag. Nat. Hist. (8) IX, 1912, p. 289, and "Terra Nova" Larval Fishes, p. 148, pl. X, fig. 2 (1916).

D. 3; A. 3; P. 15—16. One specimen, 43 (32 + 11) mm. in total length, from the Atlantic, Station 829, 25° 07′ N. 19° 20′ W., 300 metres of wire out.

The "Terra Nova" specimen, 10 mm. long, was taken at the surface to the north of New Zealand.

Brauer's type, about 20 (14 + 6) mm. long, is from the Indian Ocean.

Allector cheloniae (Heller and Snodgrass, Proc. Washington Acad. V, 1903, p. 228, fig.) described from a specimen of 27 mm., without skin or illicium, taken from the stomach of a Green Turtle, may perhaps not be distinct from *Haplophryne mollis*.

Family 4. ONEIRODIDAE

Skull elongate; trough on upper surface extending its whole length, its floor in orbital region formed by a long tract of cartilage, which extends from supraoccipital to mesethmoid; a vacuity on each side immediately in front of supraoccipital; frontals apparently completely separated; parietals present; praeoperculum attached throughout its length; three pectoral radials.

Praemaxillaries a little protractile (in two genera permanently protracted); maxillaries slender. Mouth large, horizontal or oblique; teeth acute, depressible. Dorsal and anal short or moderate, equal, or the dorsal a little the longer; caudal of 9 rays, 4 bifid and 2 above and 3 below simple. Skin blackish, typically naked (spiny in one genus).

Synopsis of the Genera.

I. Jaws equal anteriorly: praemaxillaries a little protractile.

A. Sphenotic spines present.

1. Illicium supra-rostral.

An isolated simple ray on back ..... 1. *Oneirodes*

No isolated ray on back ..... 2. *Dolopichthys*

2. Illicium arising behind snout ..... 3. *Lophodolus*

B. Sphenotics low and blunt, without spines ..... 4. *Chaenophryne*

II. Praemaxillaries extending forward far beyond lower jaw, attached to head by a wide membrane.

Skin smooth, naked; illicium on a long exserted basal ..... 5. *Lasiognathus*

Skin of lower surface and sides spiny; basal bone of illicium not exserted; illicium inserted at end of snout, emerging from membrane connecting praemaxillaries ..... 6. *Thaumatichthys*

1. ONEIRODES, Lütken 1871.

Overs. Dan. Vidensk. Selsk. Forhandl., p. 56.

Form oval, rather deep. Mouth large, somewhat oblique. Teeth moderate, unequal. Sphenotic spines present. Illicium near end of snout, followed by an isolated simple ray that appears on the middle of the back, but extends forward beneath the skin and is attached to the posterior end of the basal bone of the illicium. Dorsal and anal fins just in front of the caudal.

A single species.

1. ONEIRODES ESCHRICHTII, Lütken.

(Textfigure 17).

Overs. Dan. Vidensk. Selsk. Forhandl. 1871, p. 56, pl. II.

D. 6; A. 4; P. 17. Three or four teeth on each side of vomer. Basal bone of illicium not or but little exserted; stem of moderate length and bulb large, with a tapering tentacle-like appendage in front, a shorter one, curved and compressed, behind, and two pairs of fringed flaps.

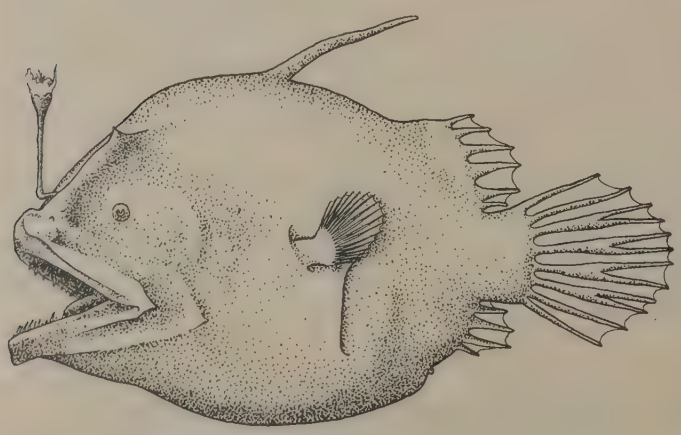


Fig. 17. *Oneirodes eschrichtii*, Lütken. After Lütken 1871.

Originally described from a specimen 205 (160 + 45) mm. long from off Greenland. One of the same size was taken by the "Dana" in the Atlantic (Station 1160, 15° 50′ N. 26° 32′ W., 1000 metres of wire out). This appears to be exactly like the type, except that the tentacle-like appendage of the illicium is considerably longer; this tentacle is in front, not behind as it is shown in Lütken's figure.

2. DOLOPICHTHYS, Garman 1899.

Mem. Mus. Comp. Zool. XXIV, p. 81.

Dermatias, Radcliffe, Proc. U. S. Nat. Mus. XLII, 1912, p. 206.

Monoceratias, Gilbert, Proc. U. S. Nat. Mus. XLVIII, 1915, p. 379.

Form deep or rather elongate. Mouth horizontal or oblique; teeth moderate or rather strong, unequal. Sphenotic spines present. Illicium inserted on snout; no isolated ray behind it.

Important specific differences are found in the relative development of a pair of spines on each side, which I propose to name articular spines, one arising from the quadrate and the other from the lower jaw. These are so close together that they look like a single spine, either simple or bifid.

Synopsis of the Species

I. Quadrate and mandibular spines very small; illicium $^1/_7$ length of fish ..... 1. *luetkeni*

II. Quadrate and mandibular spines short, equal; illicium $^1/_4$ to $^1/_2$ length of fish.... 2. *allector*

III. Articular spines well-developed, that of the quadrate longer than the mandibular (*? D. acanthias*).

A. Upper part of bulb of illicium projecting beyond its appendages.

1. Teeth in lower jaw much stronger than in upper.

Illicium (without exserted basal) $^1/_6$ to $^1/_5$ length of fish; 30 to 40 teeth on each side of lower jaw (in specimens of 40 to 65 mm.) ..... 3. *heteracanthus*

Illicium nearly $^1/_4$ length of fish; 13 to 15 teeth on each side of lower jaw (in a specimen of 80 mm.) .... 4. *acanthias*

Illicium $^1/_{10}$ length of fish (in a specimen of 34 mm.) . 5. *microlophus*

Illicium $^2/_3$ length of fish ..... 6. *danae*

2. Teeth in upper jaw nearly as strong as in lower, 15 to 20 on each side, about half of them strong canines ..... 7. *megaceros*

B. Bulb of illicium surmounted by a tuft of filamentous appendages..... 8. *platynogaster*

IV. Articular spines long and slender, the mandibular longer than that of the quadrate 9. *gracilispinis*

The following are in all probability species of *Dolopichthys*:

1. *Oneirodes niger*, A. Brauer, 1906 ("Valdivia" Tiefsee-Fische, p. 316, pl. XV, fig. 6). D. 8; A. 8. Two specimens, 13 and 15 mm. long, from the Indian Ocean.
2. *Linophryne colletti*, M. Weber, 1913 ("Siboga" Fische, p. 558). D. 6; A. 3; P. 16; C. 9. Sharp sphenotic spines. 2 teeth on each side of vomer. A damaged specimen, without illicium, 90 mm. long, from the Bali Sea. (Perhaps = *Diceratias bicornis*).
3. *Oneirodes cornutus*, Gilchrist, 1924 (S. Afr. Mar. Biol. Rep. No. 7, p. 23, pl. VI, fig. 2). A single specimen, 21 mm. long, from South Africa.

1. DOLOPICHTHYS LUETKENI, Regan 1925.

(Plate IV, fig. 2).

Ann. Mag. Nat. Hist. (9) XV, p. 562.

D. 6; A. 4. Mouth oblique; lower jaw nearly $^1/_2$ length of fish, with a minute articular spine; quadrate spine minute; a blunt projection below chin. 3 or 4 teeth on each side of vomer. Illicium $^1/_7$ length of fish; bulb with an anterior tentacle-like and a posterior curved and compressed appendage, and with a broad anterior and a slender lateral pair of fringed flaps.

Gulf of Panama, Station 1203, 7° 30′ N. 79° 19′ W., 3500 metres of wire out; one specimen, 160 (124 + 36) mm. in total length. Atlantic, Station 1140, 32° 45′ N. 16° 20′ W., 300 metres of wire out; one specimen, 24 mm. in total length.

This fish is very similar to *Oneirodes eschrichtii*; a fin-ray is attached to the posterior end of the basal bone of the illicium and runs backwards to end between the dorsal muscles, but it is much shorter than in *Oneirodes* and lies well below the skin. The specific name is in memory of C. F. Lütken, the Danish zoologist who so greatly advanced the knowledge of oceanic fishes.

2. DOLOPICHTHYS ALLECTOR, Garman 1899.

Mem. Mus. Comp. Zool. XXIV, p. 81, pls. XII—XV.

D. 6—7; A. 5—6. Mouth a little oblique; lower jaw $^1/_3$ length of fish, or less; articular spines short, equal, looking like a single spine; a mental tubercle; vomer with 1 or 2 teeth on each side, or toothless. Basal bone of illicium, when fully exserted, about as long as illicium, which is $^1/_4$ (young) to $^1/_2$ length of fish; bulb with a tentacle.

Gulf of Panama.

Nine specimens, 20 to 48 (38 + 10) mm. in total length, from Stations 1203, 1206, 1208 and 1209, with from 2500 to 3500 metres of wire out.

In specimens of 20 to 30 mm. the lower jaw is less than $^1/_3$ and the illicium $^1/_4$ the length of fish, and the vomer is toothless; some of these are notable for the length of the anterior tentacle-like appendage of the bulb of the illicium, as long as the illicium itself. In one of 48 mm. the illicium is $^1/_3$ the length of fish and the vomer has two teeth on one side and one on the other. These examples appear to belong to the species described by Garman from a specimen of 72 mm., in which the illicium is $^1/_2$ the length of the fish.

3. DOLOPICHTHYS HETERACANTHUS, Regan 1925.

(Plate V, fig. 1).

Ann. Mag. Nat. Hist. (9) XV, p. 562.

D. 5—7; A. 4—5. Mouth oblique; lower jaw $^2/_5$ to $^1/_2$ length of fish; articular spines well-developed, the quadrate longer than the mandibular; a blunt mental process. Teeth rather numerous, stronger in lower jaw than is upper; 2 or 3 teeth on each side of vomer. Basal bone, when fully exserted, as long as or longer than illicium, which is $^1/_6$ to $^1/_5$ length of fish; bulb as in *D. luetkeni*.

Gulf of Panama.

Twenty-one specimens, 16 to 90 mm. in total length, from Stations 1203, 1205, 1206, 1208 and 1209 with 1000 to 4000 metres of wire out. The smallest, 16 to 27 mm. long, are not included in the description.

4. DOLOPICHTHYS ACANTHIAS, Gilbert 1915.

Monoceratias acanthias, Gilbert Proc. U. S. Nat. Mus. XLVIII, p. 379, pl. XXII, fig. 24.

D. 6; A. 4. Very similar to *D. heteracanthus*, but teeth in lower jaw fewer and stronger.

Off Santa Cruz Island, California.

A single specimen 80 (60 + 18) mm. in total length.

This fish is evidently very similar to *D. heteracanthus*, but the teeth in the lower jaw are described and figured as 13 to 15 in number on each side, whereas in my larger examples of *D. heteracanthus* (40—65 mm.) there are 30 to 40. The quadrate (or praeopercular) spine is described as strong, but it is not clear whether it is stronger than the mandibular or not. The figure shows 6 bifid rays in the caudal fin.

5. DOLOPICHTHYS MICROLOPHUS, Regan 1925.

(Textfigure 18).

Ann. Mag. Nat. Hist. (9) XV, p. 563.

D. 7; A. 5. Teeth in upper jaw rather small, numerous, set close together; about 60 on each side. Illicium short, club-shaped, less than $^1/_{10}$ length of fish; basal bone not exserted. In other characters like *D. heteracanthus*.

Atlantic.

One specimen, 34 (27 + 7) mm. long, from Station 1159, 17° 55′ N. 24° 35′ W., 3000 metres of wire out.

Fig. 18. Head of *Dolopichthys microlophus*, Regan. (× 2).

6. DOLOPICHTHYS DANAE, sp. n.

(Plate IV, fig. 1).

D. 7; A. 5. Two spines at articulation of lower jaw, the one borne by the quadrate longer than the mandibular. Teeth slender, stronger in lower jaw than in upper, 40 or more on each side; vomer apparently toothless. Lower jaw $^1/_3$ length of fish. Illicium $^2/_3$ length of fish, articulated with a fully exserted basal bone which is more than $^1/_2$ length of fish (snout to base of caudal).

Atlantic, Station 1171, 8° 19′ N. 44° 35′ W., 6000 metres of wire out. One specimen, 95 (75+20) mm. in total length.

A fish of 24 (18 + 6) mm. from Station 1142 (33° 26′ N. 16° 59′ W., 3000 metres of wire out) appears to be a young example of this species; the basal bone of the illicium is shorter and is not fully exserted, and the illicium itself measures $^2/_5$ the length of the fish.

7. DOLOPICHTHYS MEGACEROS, Holt & Byrne 1908.

Oneirodes megaceros, Holt & Byrne, Ann. Mag. Nat. Hist. (8) I, p. 93.

Dolopichthys anisacanthus, Regan, Ann. Mag. Nat. Hist. (9) XV p. 562.

D. 5—6; A. 4—5. Closely related to *D. heteracanthus*, but teeth notably fewer and stronger. Illicium $^1/_5$ to $^1/_4$ length of fish (in specimens of 36 to 42 mm.).

Atlantic and Caribbean Sea.

Four specimens, 36 to 81 mm. in total length, from Stations 1152 (30° 17′ N. 20° 44′ W.), 1165 (12° 11′ N. 35° 49′ W.), 1183 (13° 47′ N. 61° 26′ W.) and 1256 (17° 43′ N. 64° 56′ W.), taken with 1000 to 4500 metres of wire out. An example 28 mm. long from Station 1165 (12° 11′ N. 35° 49′ W., 3000 metres of wire out) has the illicium shorter ($^1/_7$ length of fish). One of 21 mm. from Station 1370 (36° 36′ N. 26° 14′ W., 3000 metres of wire out) appears to belong to this species. Two small specimens (15 and 22 mm.) from Stations 1217 and 1273.

The three larger specimens are extremely similar to examples of *D. heteracanthus* of the same size, but have only 15 to 20 teeth on each side in the upper jaw, about half of them being strong canines, whereas in *D. heteracanthus* the teeth are about twice as numerous and are not nearly so strong.

I am indebted to Mr. G. P. Farran for the loan of the type of *Oneirodes megaceros*, a specimen 85 (63 + 22) mm. in total length, from 51° 2′ N. 11° 36′ W. The illicium proper is 15 mm. long; there are about 20 teeth on each side in the upper jaw; there is a strong quadrate spine about twice as long as the mandibular spine. The tubercle, described as a vestigial dorsal ray, appears to be due to the end of the second neural spine.

8. DOLOPICHTHYS PLATYNOGASTER, Radcliffe, 1912.

Dermatias platynogaster, Radcliffe, Proc. U. S. Nat. Mus. XLII, p. 206, pl. XVII, fig. 3.

D. 7; A. 4. Lower jaw about $^1/_3$ length of fish, "posteriorly ending in a stout bifid spine, the larger spinule curved outwards". Illicium about $^1/_5$ length of fish; bulb surmounted by many short finger-like filaments.

Philippines.

A specimen 182 mm. in length from off Luzon; depth 300 fathoms. The description of the "bifid spine" of the lower jaw perhaps indicates articular spines formed as in *D. heteracanthus*, but the head is smaller than I should expect in *D. heteracanthus* of this size, and the appendages of the bulb of the illicium appear to be different.

9. DOLOPICHTHYS GRACILISPINIS, Regan 1925.

(Plate V, fig. 2).

Ann. Mag. Nat. Hist. (9) XV, p. 563.

D. 5; A. 5. Snout decurved and mouth horizontal; lower jaw $^1/_3$ length of fish; articular spines long and slender, acute, divergent, the mandibular considerably longer than the quadrate; a small mental tubercle. 4 or 5 teeth on each side of vomer. Illicium $^1/_5$ to $^1/_4$ length of fish.

Atlantic and Pacific.

Two specimens, one 65 (52 + 13) mm. in total length, from the Gulf of Panama, Station 1206, 6° 40′ N. 80° 47′ W., 3500 metres of wire out, the other, 50 mm. long, from the Atlantic, Station 1358, 28° 15′ N. 56° 00′ W., 3000 metres of wire out.

3. LOPHODOLUS, Lloyd 1909.

Mem. Ind. Mus. II, p. 167.

As *Dolopichthys*, but illicium farther back, arising from between the sphenotics or from behind the occiput.

1. LOPHODOLUS ACANTHOGNATHUS, Regan 1925.

(Plate VI, fig. 1).

Ann. Mag. Nat. Hist. (9) XV, p. 563.

D. 8; A. 7. Snout short; mouth very oblique; lower jaw $^2/_5$ length of fish; quadrate spine slender, acute, longer than the mandibular; posterior angles of lower jaw produced into slender, acute spines; a mental spine. Illicium arising from between sphenotic spines, short, about as long as the exserted basal bone.

Atlantic.

Three specimens, one 25 (18 + 7) mm. in total length, from Station 1358, 28° 15′ N. 56° 00′ W., 3000 metres of wire out, another, 22 mm. in total length, from Station 1342, 34° 00′ N. 70° 01′ W., 4500 metres of wire out, a third, 12 mm. in total length, from Station 1239, 25° 50′ N. 76° 55′ W., 2500 metres of wire out.

2. LOPHODOLUS INDICUS, Lloyd 1909.

Mem. Ind. Mus. II. p. 167 and Ill. Zool. "Investigator", Fishes, pl. XIV, fig. 7.

D. 8; A. 7. Evidently closely related to *L. acanthognathus*, apparently differing in that the illicium arises from behind the occiput and reaches the caudal fin when laid back; but the illicium may include the basal bone pulled out of place.

Indian Ocean.

Known from a specimen 65 mm. long from off Travancore; depth 888 fathoms.

4. CHAENOPHRYNE, Regan 1925.

Ann. Mag. Nat. Hist. (9) XV, p. 564.

No sphenotic spines; posterior part of trough on upper surface of skull margined by blunt ridges. Mouth horizontal; teeth in jaws rather strong; a pair of teeth on each side of vomer. Illicium rostral; no free dorsal ray behind it.

1. CHAENOPHRYNE LONGICEPS, Regan 1925.

(Plate VI, fig. 2).

Ann. Mag. Nat. Hist. (9) XV, p. 564.

D. 7; A. 6. Head long, with upper profile decurved; lower jaw $^1/_2$ to $^3/_5$ length of fish; a minute articular (mandibular) spine; 2 pairs of teeth on vomer, the anterior of each pair strong. Basal bone of illicium, when fully exserted, about as long as illicium, which is $^1/_3$ length of fish; bulb with a filament.

Atlantic and Pacific.

Seventeen specimens, 15 to 55 mm. in total length, fifteen from Stations 1203 (7° 30′ N. 79° 19′ W.), 1208 (6° 48′ N. 80° 33′ W.) and 1209 (7° 15′ N. 78° 54′ W.) and one each from Stations 1152 (30° 17′ N. 20° 44′ W.) and 1370 (36° 36′ N. 26° 14′ W.), with 2000 to 3500 metres of wire out.

The description is mainly from two specimens, one of 30 (22 + 8) mm. from Station 1208, and one of 27 mm. from Station 1203. The rest measure 15 to 20 mm.

5. LASIOGNATHUS, Regan 1925.

Ann. Mag. Nat. Hist. (9) XV, p. 563.

Distinguished from *Dolopichthys* by the structure of the mouth. Praemaxillaries long and flexible, extending forward far beyond lower jaw, connected with head by a broad membrane that permits them to meet anteriorly either above or below the snout; in the latter position they form the margin of a membranous pouch, across the aperture of which the long and slender, bristle-like teeth meet in front of the lower jaw.

1. LASIOGNATHUS SACCOSTOMA, Regan 1925.

(Plate VII).

Ann. Mag. Nat. Hist. (9) XV, p. 563.

D. 5; A. 4. Depth about 4 in length. Head strongly compressed, very long, the sphenotic spines not much nearer to anterior end of praemaxillaries than to base of caudal. Articular spines as in *Dolopichthys gracilispinis*. Illicium about $^1/_2$ length of fish, nearly as long as the fully exserted basal bone; beyond the bulb a filament that ends in 3 hook-shaped denticles, the middle one larger than the others.

Caribbean Sea, Station 1217, 18° 50′ N. 79° 07′ W., 4000 metres of wire out.

One specimen, 75 (60 + 15) mm. in total length.

This extraordinary fish is a complete angler, with rod, line, bait and hooks. The hooks may well be used to hold the prey, which is evidently enclosed by the downward movement of the praemaxillaries, the bristle-like teeth being used not for piercing, but to close the aperture of the pouch. I suspect that Pteropods or Crustacea may form the normal prey of this fish, but I have gained no information from examination of the stomach, which is empty.

6. THAUMATICHTHYS, Smith and Radcliffe 1912.

Proc. U. S. Nat. Mus. XLII, p. 579.

Resembles *Lasiognathus* in structure of mouth, but is generically distinguished by the shorter head, the dentition, the illicium and the spinate skin of the lower half of the fish.

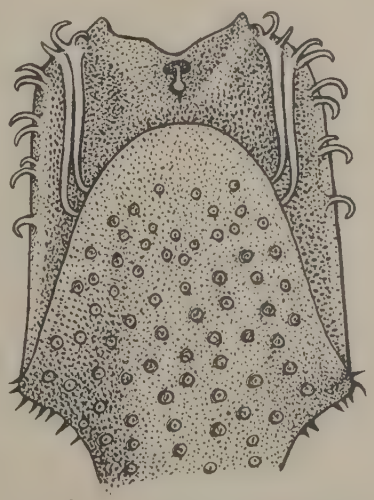


Fig. 19. *Thaumatichthys pagidostomus*, Smith and Radcliffe. Mouth seen from below (after Smith and Radcliffe).

1. THAUMATICHTHYS PAGIDOSTOMUS, Smith & Radcliffe 1912.

(Textfigure 19).

t. c. p. 580, pl. XXII.

D. 6; A. 4. Sphenotic spines about $^1/_3$ as distant from anterior ends of praemaxillaries as from base of caudal. Eye just above corner of mouth. Teeth slender, curved; each praemaxillary with an an-

terior pair of very long teeth with hooked ends. Basal bone of illicium not exserted, procumbent, extending forwards to end of snout: illicium small, directed downwards, emerging from membrane connecting praemaxillaries; beyond the bulb a filament that ends in a curved denticle. Skin of ventral surface and sides spinate, each spine on a circular base.

Gulf of Tomini, Celebes; depth 760 fathoms.

Known from a single specimen, 84 mm. in total length.

Family 5. MELANOCETIDAE

Skull broad; trough on upper surface of skull extending its whole length; a short tract of cartilage between supraoccipital and mesethmoid; parietals present; frontals completely separated, triradiate, with inner limbs separating the large vacuities of the orbital region from those of the ethmoid region; praeoperculum attached throughout its length; three pectoral radials.

Praemaxillaries a little protractile; maxillaries slender, not expanded distally. Mouth vertical, wide; teeth unequal, acute, depressible. Illicium supra-rostral; no free rays behind it; dorsal rather long, of 13 to 17 rays, extending to caudal; anal short, of 4 rays; caudal of 9 rays, 6 bifid and 1 above and 2 below simple. Skin naked, blackish.

A single genus.

1. MELANOCETUS, Günther 1864.

Proc. Zool. Soc. p. 301.

Liocetus, Günther "Challenger" Deep-Sea Fishes, p. 56 (1887).

Synopsis of the Species.

I. Lower jaw less than $^1/_2$ length of fish (snout to base of caudal).

A. Illicium not more than $^1/_3$ length of fish; interorbital width $^1/_2$ postorbital width. D. 13; P. 15—16 ..... 1. *murrayi*

B. Illicium more than $^2/_5$ length of fish; interorbital width nearly $^2/_3$ postorbital width. D. 15; P. 18 ..... 2. *ferox*

II. Lower jaw more than $^1/_2$ length of fish: P. 17—20.

A. Teeth strong, the longest nearly equal to interorbital width (between edges of frontals). D. 14—15 ..... 3. *johnsoni*

B. Teeth weaker, the longest about $^1/_2$ interorbital width.

D. 14—15. Illicium, when laid back, not nearly reaching dorsal ..... 4. *niger*

D. 16—17. Illicium, when laid back, reaching origin of dorsal ..... 5. *polyactis*

1. MELANOCETUS MURRAYI, Günther 1887.

"Challenger" Deep-Sea Fishes, p. 57, pl. XI, fig. a.

? *Melanocetus johnsoni*, Brauer, "Valdivia" Tiefsee-Fische, p. 318, pl. XV, fig. 3.

? *Melanocetus vorax*, Brauer, t. c. p. 320, pl. XV, fig. 4.

D. 13; A. 4; P. 15—16. Illicium $^2/_7$ to $^1/_3$ length of fish (snout to base of caudal). Lower jaw less than $^1/_2$ length of fish; teeth strong. Vomerine dentition variable; in one specimen a complete series of 7 rather small teeth, in others 3 or 4 irregularly spaced, in one no teeth. Interorbital width (between edges of frontals) $^1/_2$ postorbital width (between tips of sphenotics).

Atlantic and Caribbean Sea.

The type, 100 mm. in total length, from 1° 47′ N. 24° 26′ W., was said to have no teeth on the vomer; on this account Günther regarded this species as belonging to a distinct sub-genus, *Liocetus*. I find in this specimen one well-developed tooth in the middle of the vomer, and on one side, well-separated from it, two small teeth, close together.

Six examples collected by the "Dana", 30 to 110 mm. in total length, are from Stations 1156 (25° 11′ N. 20° 57′ W., 5000 metres of wire out), 1189 (17° 58.5′ N. 64° 41′ W., 5000 metres of wire out), 1269 (17° 13′ N. 64′ 58′ W., 4500 metres of wire out), 1283 (14° 38′ N. 61° 16′ W., 4000 metres of wire out), and 1342 (34° 00′ N. 70° 01′ W., 4000 metres of wire out).

2. MELANOCETUS FEROX, sp. n.

(Plate IX, fig. 1).

D. 15; A. 4; P. 18. Lower jaw less than $^1/_2$ length of fish (snout to caudal); anterior teeth strong, the longest not much less than interorbital width; a strong tooth on middle of vomer and one or two smaller ones on each side of it. Illicium a little more than $^2/_5$ length of fish. Interorbital width nearly $^2/_3$ postorbital width of head.

Gulf of Panama. Station 1208. 3100 metres of wire out.

A single specimen, 110 (82 + 28) mm. in total length, with the remains of a prawn and three examples of *Cyclothone*, each about 45 mm. long, in its mouth.

3. MELANOCETUS JOHNSONI, Günther 1864.

Proc. Zool. Soc. 1864, p. 301, pl. XXV.

? *Melanocetus krechi*, Brauer (1902), "Valdivia" Tiefsee-Fische, p. 319, pl. XV, figs. 1, 2. (1906).

? *Melanocetus rotundatus*, Gilchrist, Marine Inv. S. Afr. II, 1904, p, 206, pl. XV.

D. 14—15; A. 4; P. 17—20. Illicium $^2/_5$ to nearly $^1/_2$ length of fish. Lower jaw more than $^1/_2$ length of fish; teeth strong, the longest not much less than interorbital width (between edges of frontals). A transverse series of teeth on vomer; when complete as many as 8 or 10 teeth may be present, but usually there are gaps and sometimes only one or two teeth are evident. Interorbital width (between edges of frontals) $^3/_5$ to $^2/_3$ postorbital width (between tips of sphenotics).

Atlantic. ? Indian Ocean.

Three specimens in the British Museum (Natural History), 80 to 95 mm. in total length, are from Madeira, from 31° N. 37° W. and from 40° N. 42° W. respectively; the type from Madeira had in its stomach a partly digested specimen of a Scopeloid fish, *Lampanyctus crocodilus*, about twice its own length; each of the others had swallowed a *Lampanyctus crocodilus* three times its own length, and was found floating helpless at the surface, one in 1902, the other in 1912, by Captain Dixon, the master of a sailing barque (cf. Regan, P. Z. S. 1913, p. 1096).

The "Dana" collection includes twenty-three examples, 15 to 100 mm. long, from the Atlantic and the Caribbean Sea. One of 85 mm. had in its stomach a large prawn, which has been determined by Dr. W. T. Calman, F. R. S. as *Acanthephyra purpurea*, A. Milne-Edwards. One of 22 mm. had in its mouth a small fish (*Ichthyococcus*) and 4 small Crustacea. Specimens of 15 to 20 mm. are brownish with white fins, and have a short illicium, a small mouth and feeble teeth.

The "Dana" specimens were taken at stations 1152, 1156, 1157, 1159, 1165, 1166, 1171, 1183, 1186, 1217, 1337, 1342, 1370, with 1000 to 7000 metres of wire out.

4. MELANOCETUS NIGER, Regan 1925.

(Plate VIII, fig. 1).

Ann. Mag. Nat. Hist. (9) XV, p. 565.

D. 14—15; A. 4; P. 18—20. Illicium $^1/_3$ to $^2/_5$ length of fish. Lower jaw more than $^1/_2$ length of fish; teeth moderate, the longest not more than $^1/_2$ interorbital width. Vomer with a strong tooth on each side, sometimes accompanied by a smaller tooth; but one or both may be absent. Interorbital width about $^2/_3$ postorbital width.

Gulf of Panama.

Eleven specimens, 18 to 110 mm. in total length, from Stations 1203, 1205, 1208 and 1209 (1000—3600 metres of wire out).

This species resembles *M. johnsoni* in form, number of fin-rays, etc. but differs in the shorter illicium, the weaker teeth in the jaws, and the arrangement of the teeth on the vomer. Very small examples (18—22 mm. in total length) have a relatively small mouth and short illicium, and are brownish with white fins.

5. MELANOCETUS POLYACTIS, Regan 1925.

(Plate VIII, fig. 2).

Anm. Mag. Nat. Hist. (9) XV, p. 565.

D. 16—17; A. 4; P. 19—20. Illicium $^1/_2$ length of fish, when laid back reaching origin of dorsal. Lower jaw more than $^1/_2$ length of fish. Teeth moderate, the longest nearly $^1/_2$ interorbital width. Vomer in one specimen with four equidistant teeth, in another with five, irregularly spaced, in another with one tooth only. Interorbital width about $^2/_3$ postorbital width.

Gulf of Panama.

Three specimens, 90, 75 and 40 mm. in total length, from Stations 1206 (3500 metres of wire out) and 1209 (3500 and 2000 metres of wire out).

This species differs from the preceding in the more numerous dorsal rays, the longer illicium, and the arrangement of the teeth on the vomer.

Family 6. CERATIIDAE

Skull elongate, compressed; a large trough on the upper surface of the skull that commences behind the mesethmoid and deepens backwards; at the posterior end it is enclosed by the epiotics, which nearly or quite meet in the middle line above as well as below; parietals large; frontals meeting in front of supraoccipital; praeoperculum attached throughout its length. Three pectoral radials. Mouth moderate, with cleft vertical or very oblique; praemaxillaries protractile; maxillaries rather broad; teeth moderate, acute, depressible. Illicium on a long exserted basal which arises from interorbital region. Dorsal and anal posterior, short, of 3 to 5 rays; caudal of 8 or 9 rays, 4 bifid.

Three genera.

1. CERATIAS, Kröyer 1844.

Naturhist. Tidsskr. (2) I, p. 639.

A long ray on the back, between head and soft dorsal fin, probably always bearing a terminal bulb when complete. Skin with rather large conical spines with broad rounded bases.

1. CERATIAS HOLBOELLI, Krøyer 1844.

(Textfigure 20).

Naturhist. Tidsskr. (2) I, p. 639, and in Gaimard, Voy. Scandinavia Poiss. pl. IX.

Lütken, Dan. Vidensk. Selsk. Skr. (5) XI, 1878, p. 307, figs.; Goode and Bean, Mem. Mus. Comp. Zool. XXII, 1896, p. 489, pl. CXVII, fig. 394; Sæmundsson, Vidensk. Medd. LXXIV, 1922, p. 159, fig.; Regan, Proc. R. Soc., B. XCVII, 1925, p. 387, figs. 1—4.

D. 4; A. 4. Compressed, moderately elongate. Caudal fin large. Basal bone of illicium nearly as long as fish (without caudal); illicium with relatively short stem; bulb with terminal filament.

This species is known from seven female specimens, 440 to 1030 mm., in total length, from off Greenland, Iceland and Nova Scotia, and three males, 75 to 105 mm. long, attached to the two largest females.

In Krøyer's example the isolated ray on the back was incomplete. In the specimen of 1000 mm. from Iceland that I have described the illicium is absent, and the ray on the back is long, reaching beyond the base of caudal when laid back, and bears a terminal bulb. Wishing to know whether this was the normal structure of the ray on the back I wrote to Mr. Bj. Sæmundsson, who has kindly in-

formed me that the ray on the back is absent in both his specimens and that the illicium is complete in one only, presumably the larger, 1030 mm. in total length. In this fish, according to Sæmundsson, the illicium proper measures 148 mm. (stem 75, bulb 28, terminal filament 45) and is articulated to a long exserted basal bone about 600 mm. in length.

A fish of 130 mm. figured by Murray and Hjort (Depths of the Ocean, fig. 59) appears to me to be in all probability a young example of *C. holboelli*. It was taken in the Atlantic (28° 2′ N. 14° 17′ W.) and, if my identification is correct, is evidence that the distribution of *C. holboelli* parallels that of *Himantolophus groenlandicus*, neither species being confined to northern waters.

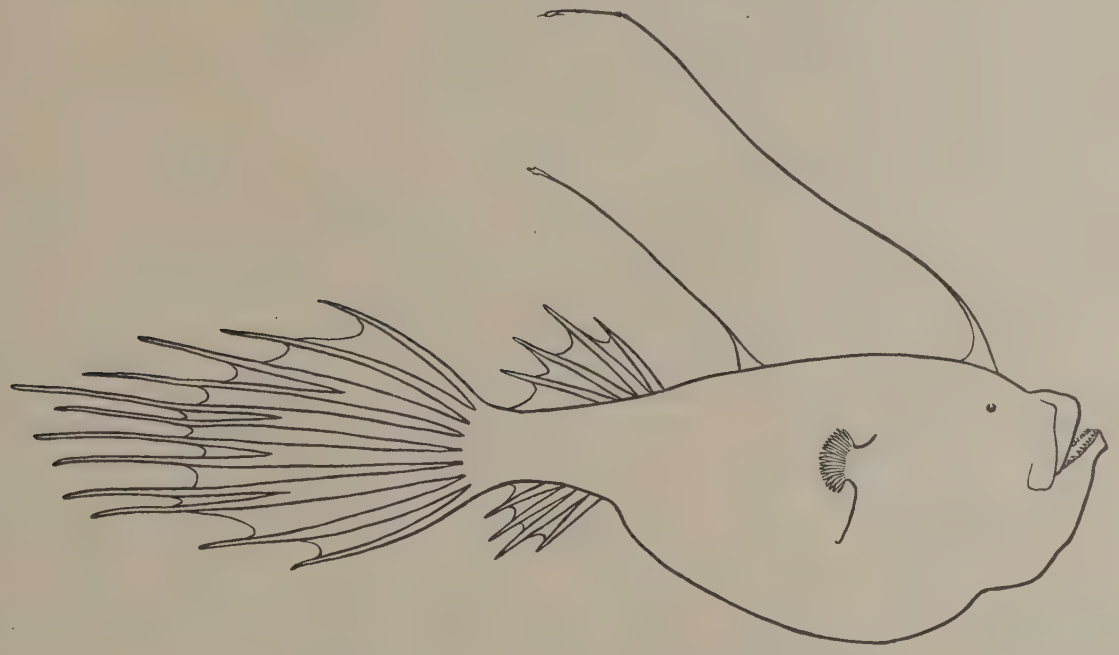


Fig. 20. *Ceratias holboelli*, Kröyer. After Kröyer.
(The ray on back restored from specimen in British Museum).

2. CRYPTOSPARAS, Gill 1883.

"Forest and Stream", p. 284.

Paraceratias, Tanaka, J. Coll. Sci. Tokyo XXIII 1908, (13) p. 18.

Ovate, compressed; skin spinulose, with numerous minute close-set prickles. Post-cephalic part of spinous dorsal fin represented by four rays just in front of soft dorsal, the anterior either moderately long and tentacle-like or reduced to a subcutaneous gland, the three others in the form of a large median and two smaller lateral sessile oval caruncles.

Two species.

1. CRYPTOSPARAS COUESII, Gill 1883.

(Plate IX, fig. 2).

Cryptosparas couesii, Gill, "Forest and Stream", 1883, p. 284; Goode and Bean, Mem. Mus. Comp. Zool. XXII, 1896, p. 491, fig. 402; Regan, Proc. R. S., B. XCVII, 1925, p. 393, fig. 5.

Ceratias couesii, Brauer, "Valdivia" Tiefsee-Fische, p. 317, pl. XV, fig. 7 (1906); Sæmundsson, Vidensk. Medd. LXXIV, 1922, p. 100, pl. III, C.

D. 4; A. 4. Form oval, compressed. Basal bone of illicium about $^1/_2$ length of fish; illicium with very short stem; bulb with terminal filament. A large median and two smaller lateral sessile oval caruncles; in front of them a subcutaneous gland with a pore.

This species is represented in the British Museum Collection by a specimen of 210 (170 + 40) mm. from the Bay of Biscay; in this fish the illicium (stem + bulb) is 4 mm. long and the basal bone 90 mm. *C. couesii* is also known from the Western Atlantic (GILL, GOODE and BEAN), from Iceland (SÆMUNDSSON), and from the Gulf of Aden (BRAUER). The "Dana" obtained a large series of small specimens (14 to 37 mm.) from the Atlantic and one (16 mm.) from the Gulf of Panama (Station 1208, 2100 metres of wire out).

The Stations in the Atlantic at which this species was found are given below, with the numbers of metres of wire out in brackets. Stations 1019 (150), 1024 (300); 1041 (110 and 150); 1043 (150); 1162 (300); 1168 (300 and 600); 1172 (600); 1228 (1000); 1230 (1500); 1322 (2300 and 1900); 1339 (1000); 1341 (200 and 150); 1342 (3000); 1345 (300); 1353 (200); 1356 (1000); 1358 (2000 and 3000); 1365 (300 and 4000). There is little correlation between the size of the specimens and the depths to which the nets descended; one of 30 mm. is from Station 1341 (200) and two of 14 and 15 mm. from Station 1322 (1900 and 2300); the largest, 37 mm., is from Station 1230 (1500).

In the majority of these specimens the basal bone of the illicium is fully exserted and varies from about $^1/_4$, in examples of 20 to 25 mm., to $^1/_2$, in the larger ones, of the length without caudal fin. In very small examples, 15 to 17 mm. long, the basal bone is not fully exserted and in the smallest, 14 (10 + 4) mm. long, it does not project at all, the very short illicium being inserted directly on the head.

The largest known example of *C. couesii* is one of 300 (220 + 80) mm. from Iceland. Mr. SÆMUNDSSON has very kindly sent me this specimen for examination; he had recorded it as a male, but it proves to be a female, inspection of a small portion of the ovary under a low power of the microscope revealing a number of small ova. In view of the importance of the correct determination of the sex of this fish I asked Dr. H. G. CANNON to examine it, and he confirms my opinion. In this fish, as SÆMUNDSSON has noted, the two middle caudal rays (80 mm.) are nearly twice as long as the next pair (45 mm.), each branch being prolonged into a filament which ends in an oval swelling with a terminal pore, a structure evidently essentially similar to the 'caruncles' and the bulb of the illicium; these prolongations of the rays are so delicate that they would easily be broken off, so that it is not surprising that they have not been described in other examples; but they appear to be absent in young specimens and may not be developed until a considerable size is attained. The basal bone of the illicium is $^5/_9$ the length of the fish (without caudal fin). In the stomach are the remains of the skull and vertebral column of a fish, apparently an *Argentina*, about 100 mm. long.

2. CRYPTOSPARAS MITSUKURII, Tanaka 1908.

? *Ceratias carunculatus*, Günther, "Challenger" Deep-Sea Fishes, p. 55, pl. XI, fig. D (1887).

Paraceratias mitsukurii, Tanaka, J. Coll. Sci. Tokyo, XXIII, 1908 (13) p. 18, pl. II, fig. 3 and "Fishes of Japan" II, 1911, p. 30, pl. VIII, fig. 25.

D. 4; A. 4. Basal bone of illicium less than $^1/_2$ length of fish. Caruncles as in *C. couesii*; in front of them a moderately long tentacle-like ray.

Japan.

The type is 440 mm. in total length, and it is possible that the development of the ray on the back may be due to its large size; the uppermost and lowest rays of the caudal (the only complete ones) have terminal bulbs, comparable to those of the middle caudal rays of the 300 mm. *C. couesii* described above. The type of *Ceratias carunculatus* is 35 (28 + 7) mm. long; the basal bone of the illicium measures 9 mm. (as compared with 13 mm. in a *C. couesii* of this size); the ray in front of the caruncles is represented by a slight prominence, under which is a gland with a pore. Until more material is available it is difficult to say whether there are two Japanese species or one, or whether either is distinct from *C. couesii*.

3. MANCALIAS, Gill 1878.

Proc. U. S. Nat. Mus. I, p. 227.

Typhlosparas, Gill, "Forest and Stream", 1883, p. 284.

Myosparas, Gilbert, Bull. U. S. Fish. Comm. 1903 (1905) p. 694.

Strongly compressed, rather elongate, tapering posteriorly. Skin spinulose, with numerous minute close-set prickles. Post-cephalic part of spinous dorsal fin represented by a pair of stalked caruncles and by a subcutaneous gland in front of them.

1. MANCALIAS URANOSCOPUS, Murray 1878.

(Textfigure 21).

Ceratias uranoscopus, Günther, "Challenger" Deep-sea Fishes, p. 54, pl. XI, fig. C.

Mancalias shufeldti, Gill, "Forest and Stream", 1883, p. 284; Goode & Bean, Mem. Mus. Comp. Zool. XXII, 1896, p. 490, fig. 601.

Mancalias uranoscopus, Goode & Bean, l. c.

Myosparas myops, Gilbert, Bull. U. S. Fish. Comm. 1903 (1905) p. 694, pl. XCIX.

D. 3—5; A. 4. Basal bone of illicium long, slender and flexible, $^3/_5$ to $^2/_3$ length of fish, about 3 times as long as the illicium, which ends in a small bulb. A pair of stalked caruncles in front of dorsal fin, immediately behind a low median prominence, beneath which is a gland with terminal pore, similar to the glands of the caruncles.

The type of the species, 76 (60 + 16) mm. long, is from the North Atlantic.

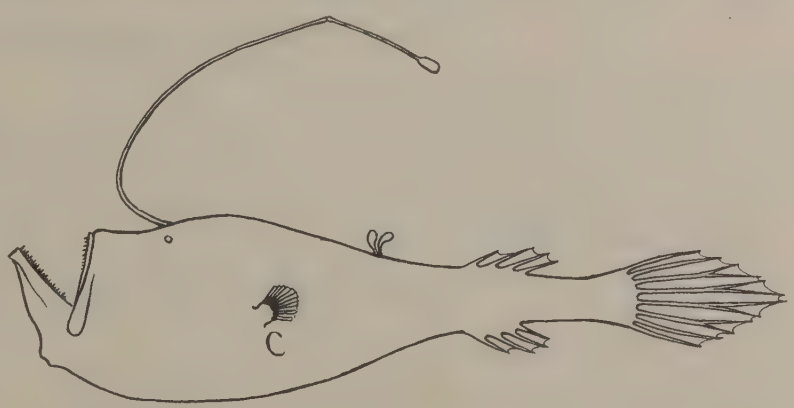


Fig. 21. *Mancalias uranoscopus*, Murray. After Goode & Bean 1896.

Two other specimens, one the type of *M. shufeldti*, are known from the Western Atlantic. Gilbert's *Myosparas myops* from the Sandwich Islands was described from a specimen 114 mm. long, lacking the illicium. Two examples were obtained by the "Dana" in the Caribbean Sea, one 66 mm. in total length from Station 1253, 17° 43′ N. 64° 56′ W., 1000 metres of wire out (in this fish, as in Gilbert's, the illicium has been lost), the other 56 mm. in total length, from Station 1269, 17° 13′ N. 64° 58′ W., 4500 metres of wire out (this specimen has 5 rays in the dorsal fin). A third "Dana" specimen, 110 mm in total length, is from the Atlantic, St. 1172, 7° 22′ N. 46° 51′ W., 600 metres of wire out.

Family 7. GIGANTACTINIDAE

Trough on upper surface of skull extending its whole length; epiotics and parietals nearly meeting in middle line above posterior end of trough; frontals meeting in front of supraoccipital; mesethmoid very long, projecting anteriorly; praeoperculum attached throughout its length.

Elongate, compressed; head rather small. Mouth moderate, non-protractile, horizontal. Illicium inserted at end of snout. Dorsal and anal short; caudal rays simple. Skin blackish.

Two genera.

1. GIGANTACTIS, A. Brauer 1902.

"Valdivia" Tiefsee-Fische, p. 322 (1906).

Snout produced in front of mouth. Teeth moderately strong, depressible, curved inwards; about 1 to 3 series in upper jaw, 2 to 4 in lower, the outer teeth longest; similar teeth on upper pharyngeals; palate toothless. Skin spinulose.

1. GIGANTACTIS VANHOEFFENI, A. Brauer 1902.

"Valdivia" Tiefsee-Fische, p. 322, pl. XV, figs. 8, 9 (1906).

D. 6; A. 6. Illicium as long as or a little shorter than fish. Origin of dorsal nearly twice as distant from end of snout as from base of caudal.

This species was described from two specimens, 35 and 30 mm. in length to base of caudal, from the Indian Ocean.

A specimen of 70 (55 + 15) mm. from the Atlantic (Station 1181. 13° 07′ N. 57° 20′ W., 4000 metres of wire out) agrees closely with BRAUER's description and figure, the only difference being that the expansion at the end of the cephalic ray is strongly pigmented between the luminous organ and the terminal filaments. Another fish of 32 (25 + 7) mm. from the Caribbean Sea (Station 1217. 18° 50′ N. 79° 07′ W., 2500 metres of wire out) seems to be of the same species, but the cephalic ray is only $^2/_3$ the length of the fish. A third, 30 mm. long, is from St. 1156 (25° 11′ N. 20° 57′ W.)

2. GIGANTACTIS GRACILICAUDA, Regan 1925.

(Plate X, fig. 2).

Ann. Mag. Nat. Hist. (9) XV p. 565.

D. 6; A. 6. Illicium as long as fish. Origin of dorsal equidistant from eye and base of caudal. Caudal peduncle long and slender.

One specimen, 107 (85 + 22) mm. in total length, from the Caribbean Sea. Station 1183, 13° 47′ N. 61° 26′ W., 4500 metres of wire out.

3. GIGANTACTIS MACRONEMA, Regan 1925.

(Plate XI).

Ann. Mag. Nat. Hist. (9) XV p. 565.

D. 6; A. 5. Illicium four times as long as fish. Origin of dorsal a little nearer to base of caudal than to end of snout. Caudal peduncle long and slender.

One specimen, 133 (100 + 33) mm. in total length, from the Atlantic, Station 1365, 31° 47′ N. 41° 41′ W., 5000 metres of wire out.

2. RHYNCHACTIS, Regan 1925.

Ann. Mag. Nat. Hist. (9) XV p. 565.

Snout truncated, not produced in front of mouth. Teeth in jaws minute, in several series; on each side an external pair of anterior canines in front of upper jaw; strong teeth on upper pharyngeals; skin naked.

1. RHYNCHACTIS LEPTONEMA, Regan 1925.

(Plate X, fig. 1).

Ann. Mag. Nat. Hist. (9) XV p. 566.

D. 3; A. 3. Head rather short and broad; illicium slender, at least $1^1/_2$ length of fish, inserted above end of snout. Origin of dorsal equidistant from eye and base of caudal. Caudal peduncle slender.

One specimen, 57 (42 + 15) mm. in total length, from the Atlantic, Station 1171, 8° 19′ N. 44° 35′ W., 3000 metres of wire out. The illicium is broken, so that its length when complete is unknown.

Family 8. NEOCERATIIDAE

This family is proposed for a remarkable fish that has no illicium, but does not resemble the Aceratiidae in other respects, and seems more likely to be related to the Gigantactinidae, or perhaps to the Oneirodidae.

1. NEOCERATIAS, Pappenheim 1914.

Deutsche Südpolar-Exped. XV, Zool. VII, p. 198.

No illicium. Form moderately elongate; head rather large. Skin smooth, naked. Mouth rather wide, little oblique; teeth represented by slender movable spines, each inserted in a small muscular pad and ending in a double-hook, arranged in series parallel to the jaws, three series above the mouth and two below it; teeth (or spines) nearest the mouth the shortest; those of upper outer series the longest and set quite on the upper surface of the snout, the last just below the eye. Large nasal tentacles just in front of the eyes. Sphenotic spines present (judging from the figure). Dorsal and anal fins well separated from caudal, rather long, opposed (number of rays uncertain).

1. NEOCERATIAS SPINIFER, Pappenheim 1914.
(Textfigure 22).

t. c. p. 198, fig. 10.

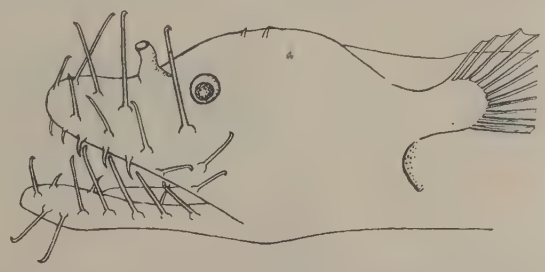


Fig. 22. Head of *Neoceratias spinifer*, Pappenheim. After Pappenheim 1914.

Known from a single specimen, 25 mm. in length to base of caudal, from the South Atlantic (12° 11′ S. 6° 16′ W.) taken in a net over a depth of 2000 metres.

I believe that *Neoceratias* may be related to the Gigantactinidae, because *Gigantactis* differs from other Ceratioids in having the outer teeth larger than the inner, and moreover placed on the outer side of the jaws and inserted in muscular pads, a type of dentition from which that of *Neoceratias* might readily have been derived. But it is possible that this indication may be misleading and that certain resemblances to *Dolopichthys* may be of more importance.

Family 9. HIMANTOLOPHIDAE

Trough on upper surface of skull extending its whole length; parietals absent; frontals separated, but nearly meeting in front of supraoccipital; praeoperculum attached throughout its length; two pectoral radials.

Mouth oblique. Illicium supra-rostral; dorsal and anal fins short; caudal of 9 rays, 6 bifid, and 1 above and 2 below simple. Skin blackish.

Two genera.

1. HIMANTOLOPHUS, Reinhardt 1837.

Dansk. Vidensk. Selsk. Afhandl. (4) VII, p. 116.
Aegeonichthys, Clarke, Tr. N. Zeal. Inst. X, 1878, p. 245.
Corynolophus, Gill, Proc. U. S. Nat. Mus. 1878, p. 219.

Form oval. Skin thick, with large scattered rounded bony plates, each of which bears a median spine. Mouth moderate, oblique, non-protractile; teeth in jaws acute, depressible, in 3 to 5 series, the inner largest; no teeth on vomer.

Illicium with several long tentacles distally; no free ray behind it. First, or first two rays of dorsal and anal simple, the rest bifid.

1. HIMANTOLOPHUS GROENLANDICUS, Reinhardt 1837.

(Textfigure 23; Plate XII, fig. 1).

Dansk. Vidensk. Selsk. Afhandl. (4) VII, pp. 116, 136, pl. IV; GIRARD, Bull. Soc. Geogr. Lisboa, XI, 1893, p. 603, pl. I.

Himantolophus reinhardtii, Lütken, Dansk. Vidensk. Selsk. Skr. (5) XI, 1878, p. 309, pls. I, II, and (6) IV, 1887, p. 323, fig.; HOLT and BYRNE, in WOLFENDEN, Sci. Res. N. Atlantic, p. 195, pls. I, II (1909); WILLIAMSON, Rep. Fishery Board Scotland 1909 (1911) p. 51, pl. III.

Corynolophus sagamius, Tanaka, Fishes of Japan, XXVII, p. 491, pl. CXXXIV, fig. 377 (1918).

Corynolophus globosus, Tanaka, o. c. XXIX, p. 529, pl. CXXXIX, fig. 388 (1918).

Fig. 23. *Himantolophus groenlandicus*, Reinhardt. After LÜTKEN 1878.

D. 5; A. 4; P. 16—17. Illicium with stout stem of moderate length; distal surface of bulb with 4 divergent lobes at the margin of a prominence that bears two appendages that resemble a pair of hands, each with 4 digits; bulb with a pair of tentacle-like processes, one anterior, one posterior; distal part of stem with pairs of long tentacles, the upper reaching dorsal fin when laid back. Blackish; tips of digitiform processes and of tentacles white, probably luminous in life.

The known specimens of this species are:

1. The type, from Greenland, 580 mm. long; only the illicium has been preserved and has been described and figured by LÜTKEN.
2. The type of *H. reinhardtii*, from Greenland, 400 (300 + 100) mm. long.
3. An example from off Portugal, taken at a depth of 150 metres, described by GIRARD; this measured 450 (360 + 90) mm. in total length.
4. A specimen from Iceland, 405 mm. long, described and figured by WILLIAMSON.
5. A specimen in the British Museum (Natural History), from off Gibraltar, taken at a depth of 35 fathoms. This is 360 (280 + 80) mm. long and was figured by HOLT and BYRNE.

6. A specimen 305 mm. long sent to me from the Fisheries Laboratory, Aberdeen. This may have been landed at Aberdeen by a trawler from Iceland.
7. A specimen from Iceland, 205 mm. long, described by LÜTKEN.
8. A fish measuring 47 (33 + 14) mm. in length, taken by the "Dana" in the Atlantic (Station 1166, 10° 16′ N. 40° 41′ W., 1000 metres of wire out).

9-12. Four post-larval examples, three (13—18 mm.) from "Dana" St. 1142 (33° 26′ N. 16° 59′ W.) 4000 metres of wire out, and one (14 mm.) from "Dana" St. 1322 (27° 02′ N. 53°39′ W.) 2000 metres of wire out.

13, 14. Two post-larval examples from the tropical Atlantic, described and figured by LÜTKEN.

In addition TANAKA has described and figured two examples from Sagami Bay, Japan, respectively 260 and 338 mm. in total length. I am of the opinion that both of these belong to one species, and I am unable to find any reason for regarding them as specifically distinct from the Atlantic form.

LÜTKEN was justified in giving a new name to a fish that appeared to differ from *H. groenlandicus* in form, in the structure of the illicium, and in the number of fin-rays. But since then WILLIAMSON has described a fish agreeing in form with the type (depth $2^1/_2$ in the length) and there can be little doubt that this apparent lesser depth is due to the spreading out of the lateral bones of the head (compare also TANAKA's figures). The series now available also shows clearly that the difference in the illicium is not specific; taking specimens 1 to 8 in order (omitting No. 3, in which the illicium had been lost) the total number of tentacle-like appendages is 11, 8, 8, 9, 4, 7, 1, 0. It is clear that the posterior tentacle of the bulb is the first to develop, that the anterior one of the bulb and the upper pair on the stem appear next, and that afterwards successive pairs are added below these; the size of the fish when they appear is evidently subject to considerable variation, LÜTKEN's 207 mm. fish having 3 more tentacles than one of 305 mm. that I have examined. In some specimens nearly all the tentacles remain simple, in others several become branched.

The type of *H. groenlandicus* was said to have 12 pectoral rays, but it is easy to undercount the rays of this fin. The most serious difficulty is that REINHARDT gave the number of rays in the dorsal fin as 9; this suggests that he counted the bifid rays as two, but against this interpretation is the fact that he also stated that the first ray was simple and the rest bifid. Nevertheless, I am of the opinion that he did count the bifid rays as two, and that he added the observation as to the rays being bifid without making the necessary correction as to their number in his notes. The improbability that there are two large fishes in northern waters, identical in other characters, but markedly different in fin-structure, is very great.

A young fish measuring 47 (33 + 14) mm. in total length was taken by the "Dana" in the Atlantic (Station 1166, 10° 16′ N. 40° 41′ W., 1000 metres of wire out). The skin is naked, smooth. The illicium ends in a bulbous expansion, bearing a short filament posteriorly and ending in a disc with 4 divergent lobes; the filament is the first representative of the tentacles of the adult. The colour is brownish, with the fins pale; the illicium is pale, with the pigment of an inner sac showing through the transparent skin of the bulb. The fish connects the post-larval specimens described by LÜTKEN, and others taken by the "Dana", with the larger fish described above.

LÜTKEN's specimen of 207 mm. appears to be nearly adult in structure, except that the distal appendages of the bulb of the illicium are represented by a pair of small conical outgrowths; in my example of 305 mm. one of these appendages is fully developed, with 4 digitiform processes, and the other is short and simple.

2. HIMANTOLOPHUS APPELII, Clarke 1878.

Aegeonichthys appelii, Clarke, Tr. N. Zeal. Inst. X, 1878, p. 245, pl. VI; WAITE, Tr. N. Zeal. Inst. XLIV, 1911, p. 194, pl. V.

D. 5; A. 4; P. 17. Distinguished from *H. groenlandicus* by the structure of the illicium. From a cup in the summit of the bulb arises a stout tentacle which divides at a short distance above its in-

sertion, each branch bearing two shorter twigs at about half its height; principal branches tapering, as long as stem of illicium. Immediately behind the cup two much longer tentacles, each with 6 branches, arise from a common base; below them, on the posterior part of the bulb, two small simple tentacles; no tentacles on the stem. Terminal parts of all the branches white, probably luminous in life.

New Zealand.

The type, about 310 mm. long, was washed ashore; a second example, about 340 (270 + 70) mm. long, was caught on a line by fishermen at Port Nicholson and was fully described and figured by Waite.

2. DICERATIAS, Günther 1887.

"Challenger" Deep-Sea Fishes, p. 52.

Paroneirodes, Alcock, Ann. Mag. Nat. Hist. (6) VI, 1890, p. 206.

Aeschynichthys, Ogilby, Proc. R. S. Queensland, XX, 1906, p. 25 [*Diceratias* supposed to be preoccupied by *Diceratia*, Oken 1815].

Form ovate. Skin spinulose. Mouth larger than in *Himantolophus*, slightly protractile; teeth in jaws in 2 or 3 series, inner largest, stronger than in *Himantolophus*; 2 or 3 teeth on each side of vomer. Illicium without tentacles; just behind it a small club-shaped ray; dorsal and anal rays simple. Sphenotic spines strong.

1. DICERATIAS BISPINOSUS, Günther 1887.

(Textfigure 24).

Ceratias (Diceratias) bispinosus, Günther, "Challenger" Deep-Sea Fishes, p. 53, pl. XI, fig. B; Alcock, "Investigator" Deep-Sea Fishes, p. 56 (1899) and Ill. Zool. "Investigator", pl. XXXV, fig. 2.

Illicium about $^1/_3$ length of fish and nearly 10 times as long as the ray behind it; terminal bulb with a few short filaments. D. 6; A. 4; P. 14—15. Skin spinulose.

The type of the species was taken off Banda (depth 360 fathoms); it measures 80 (55 + 25) mm. in total length. A second specimen, 140 mm. in total length, from off Malabar, has been described by Alcock.

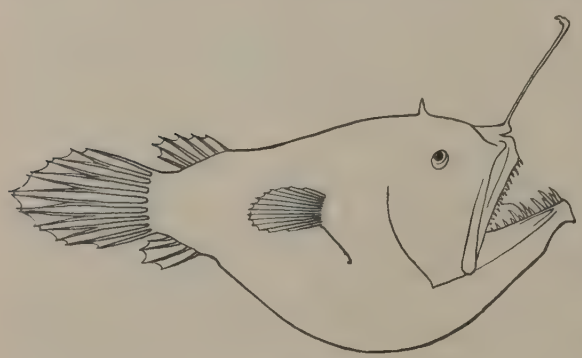


Fig. 24. *Diceratias bispinosus*, Günther. After Alcock.

2. DICERATIAS GLOMERULOSUS, Alcock 1890.

Paroneirodes glomerulosus, Alcock, Ann. Mag. Nat. Hist. (6) VI, p. 206, pl. IX, fig. 6.

Oneirodes glomerulosus, Alcock, "Investigator" Deep-Sea Fishes, p. 57 (1899) and Ill. Zool. "Investigator", pl. XXVIII, fig. 4.

Illicium about $^1/_3$ length of fish and twice as long as the ray behind it. D. 6; A. 4. Skin naked.

Known from the type, 28 (21 + 7) mm. in total length, from the Bay of Bengal.

Some of the features of this small fish (e. g. the naked skin) are undoubtedly juvenile, and it may not be specifically distinct from *D. bispinosus*.

Family 10. ACERATIIDAE

Illicium absent, but a long basal bone present; anterior part of basal bone fixed to mesethmoid, posterior part free, lying in a trough that extends backwards to the epiotics, which are separated by a groove; frontals nearly or quite meeting; parietals absent; praeoperculum attached throughout its length.

Mouth small. Dorsal and anal fins short, posterior; caudal with 4 or 6 bifid rays. Skin with scattered spinules, blackish (smooth and unpigmented in small specimens).

The loss of the illicium indicates that the Aceratiidae rely on sight and smell to find their prey, probably small Crustacea. The eyes are small, but in *Aceratias* they are telescopic and are directed forwards; the olfactory sacs and nostrils are much larger than in other Ceratioids (except *Neoceratias*), and in some species are extraordinarily developed.

Synopsis of the Genera.

I. No rostrum. Praemaxillaries meeting dentaries when mouth is closed ..... 1. *Lipactis*

II. In front of praemaxillaries a series or group of rostral denticles that meet the anterior teeth of the lower jaw.

Eyes not telescopic ..... 2. *Rhynchoceratias*

Eyes telescopic ..... 3. *Aceratias*

1. LIPACTIS, Regan 1925.

Ann. Mag. Nat. Hist. (9) XV, p. 566.

Mouth small, terminal, oblique; teeth small; praemaxillaries meeting dentaries when mouth is closed. Snout short, not projecting, without enlarged spinules. Nostrils moderate, the posterior the larger. Eyes not telescopic.

1. LIPACTIS TUMIDUS, Regan 1925.

(Plate XII, fig. 2).

Ann. Mag. Nat. Hist. (9) XV, p. 566.

D. 5—7; A. 4—5. Form ovate, broad and deep, the depth about $^1/_2$ the length.

North Atlantic, Stations 1171 (8° 19′ N. 44° 35′ W., 4000 metres of wire out) and 1186 (17° 54′ N. 64° 54′ W., 4000 metres of wire out).

Two specimens; total length 33 (24 + 9) mm.

One of the types has 5 rays in the dorsal fin, the other 6. A fish of 25 mm. with 7 rays in the dorsal fin from St. 1186, 3000 metres of wire out, appears to be an example of this species, also one of 24 mm. with 5 dorsal rays, from St. 1154 (100 metres of wire out). In both these small specimens the skin is smooth and transparent, as it is in two others, 21 mm. (St. 1358) and 10 mm. (St. 1152).

2. RHYNCHOCERATIAS, Regan 1925.

Ann. Mag. Nat. Hist. (9) XV p. 566.

Mouth small; praemaxillary teeth minute or absent; a series or group of downwardly hooked denticles at end of snout, projecting in front of praemaxillaries and biting against the enlarged anterior teeth of lower jaw. Posterior nostril the larger. Eyes not telescopic.

Four species.

1. RHYNCHOCERATIAS BREVIROSTRIS, Regan 1925.

(Textfigure 25 a; Plate XIII, fig. 1).

Ann. Mag. Nat. Hist. (9) XV p. 566.

D. 5; A. 4. Depth $2^1/_3$ in length. Rostral projection short, with a single series of denticles. Nostrils moderate, the posterior smaller than and well separated from eye; nasal area pigmented.

N. Atlantic, Station 1171 (8° 19′ N. 44° 35 W., 6000 metres of wire out); one specimen, 40 mm. in total length. A specimen 15 mm. in total length from St. 1358 (28° 15′ N. 56° 00′ W., 6000 metres of wire out) may also belong to this species.

2. RHYNCHOCERATIAS LEUCORHINUS, Regan 1925.

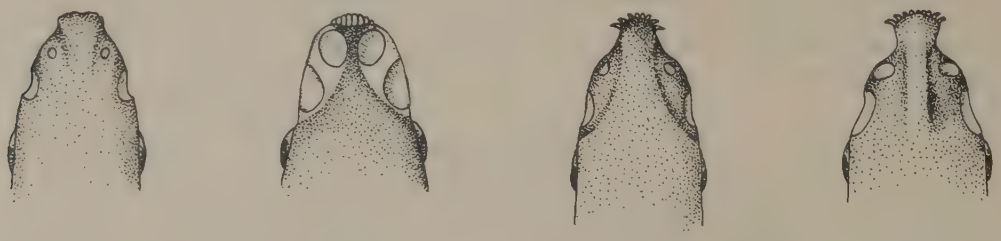
(Textfigure 25b; Plate XIII, fig. 2).

Ann. Mag. Nat. Hist. (9) XV, p. 566.

D. 4—5; A. 4. Depth about $3^1/_2$ in length. Rostral projection short, with a single series of denticles. Nostrils large, the posterior contiguous to eyes, the anterior narrowly separated from each other at end of snout. Nasal area white.

N. Atlantic, Sts. 1142 (33° 26′ N. 16° 59′ W.), 1261 (19° 04′ N. 65° 43′ W.), 1358 (28° 15′ N. 56° 00′ W.) and Gulf of Panama (Sts. 1203, 1206, 1208). 2500—5000 metres of wire out.

17 specimens, all less than 26 mm. in total length.



a *b* *c* *d*

Fig. 25. Dorsal view of heads of *a. Rhynchoceratias brevirostris*, Regan, *b. R. leucorhinus*, Regan, *c. R. oncorhynchus*, Regan, *d. R. rostratus*, Regan.

3. RHYNCHOCERATIAS ONCORHYNCHUS, Regan 1925.

(Textfigure 25c; Plate XIII, fig. 3).

Ann. Mag. Nat. Hist. (9) XV, p. 566.

D. 4—5; A. 4. Depth $3^1/_2$ in length. Rostral projection long, decurved, with a group of denticles; lower jaw with an anterior prominence bearing strong teeth. Nostrils moderate, the posterior well separated from and smaller than eye. Nasal area pigmented.

N. Atlantic, Stations 1156 (25° 11′ N. 20° 57′ W., 5000 metres of wire out), 1171 (8° 19′ N. 44° 35′ W., 6000 metres of wire out), 1189 (17° 58.5′ N. 64° 41′ W., 4000 metres of wire out), 1239 (25° 50′ N. 76° 55′ W., 3000 metres of wire out) and 1358 (28° 15′ N. 56° 00′ W., 4000 metres of wire out).

Five specimens, 21 to 45 (35 + 10) mm. in total length.

4. RHYNCHOCERATIAS ROSTRATUS, Regan 1925.

(Textfigure 25d; Plate XIII, fig. 4).

Ann. Mag. Nat. Hist. (9) XVI p. 567.

D. 5; A. 4. Rostrum and mouth as in *R. oncorhynchus*, but form somewhat deeper (depth 3 in length), snout a little shorter, and nostrils larger, the posterior near eye and equal to eye in vertical diameter.

Gulf of Panama. The type, 38 (29 + 9) mm. in total length, is from St. 1209 (7° 15′ N. 78° 54′ W., 3500 metres of wire out). A second specimen of 30 mm., is from St. 1208, 3500 metres of wire out; a third, 16 mm., from St. 1209, 2500 metres of wire out, may belong to this species.

3. ACERATIAS, A. Brauer 1902.

"Valdivia" Tiefsee-Fische, p. 323 (1906).

Near *Rhynchoceratias*, but eyes telescopic, directed forwards. In both species the head is broader and the snout shorter than in any of *Rhynchoceratias*; as a result the eyes have a clear view ahead. The nostrils are situated in a white nasal area which projects outwards and forwards on each side of the snout.

Fig. 26. Dorsal view of head of *Aceratias indicus*, A. Brauer. After Brauer 1906.

The rostral projection is small, but well-defined; it bears a few denticles. The dorsal and anal fins are very small, of 2 or 3 rays, the tips of which project just in front of the caudal.

1. ACERATIAS INDICUS, A. Brauer 1902.

(Textfigure 26).

"Valdivia" Tiefsee-Fische, p. 325, pl. XVI, figs. 6—9 (1906).

No supraorbital spines.

The species, originally described from the Indian Ocean, is represented in the "Dana" collection by five specimens, 20 to 23 mm. in total length, from the N. Atlantic (Stations 1142, 1152, 1239, 1358), taken with 2500 to 5000 metres of wire out.

2. ACERATIAS MACRORHINUS, A. Brauer 1902.

(Textfigure 27).

"Valdivia", Tiefsee-Fische, p. 324, pl. XVI, figs. 4—5 (1906).

A sharp spine projecting outwards above and behind each eye. Originally described from a specimen from the South Atlantic, about 30 (21 + 9) mm. in length.

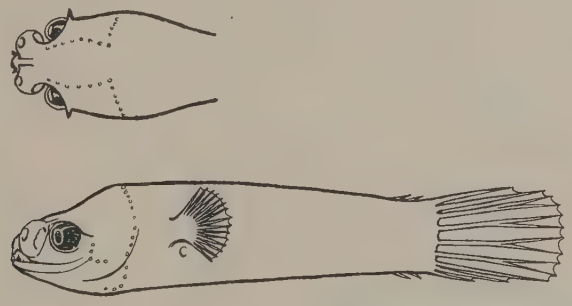
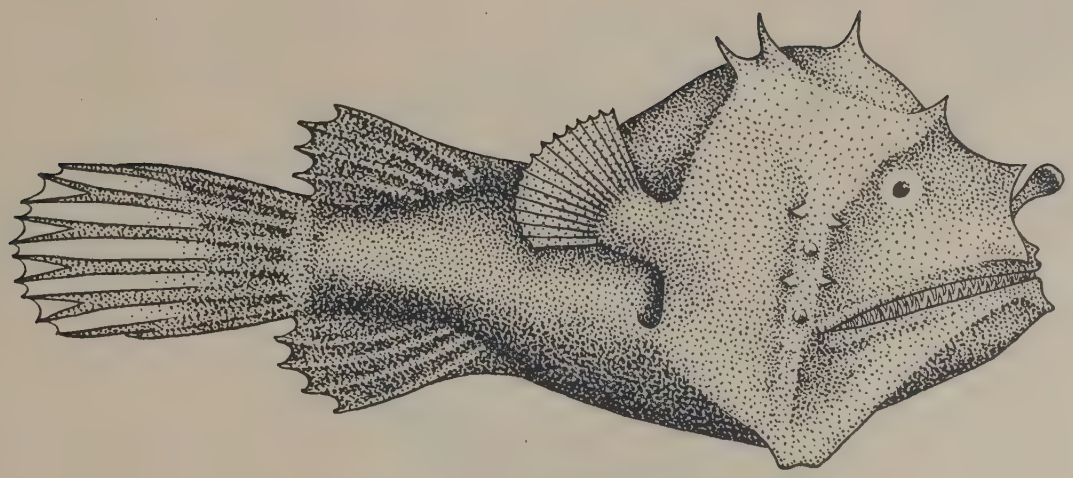


Fig. 27. *Aceratias macrorhinus*, A. Brauer. After Brauer 1906.

7 specimens in the "Dana" collection, 19—28 mm. long, are from the Gulf of Panama, Stations 1206, 1208 and 1209, 1200—4500 metres of wire out. Four of these, 19—25 mm., are unpigmented, the others are pale brownish.



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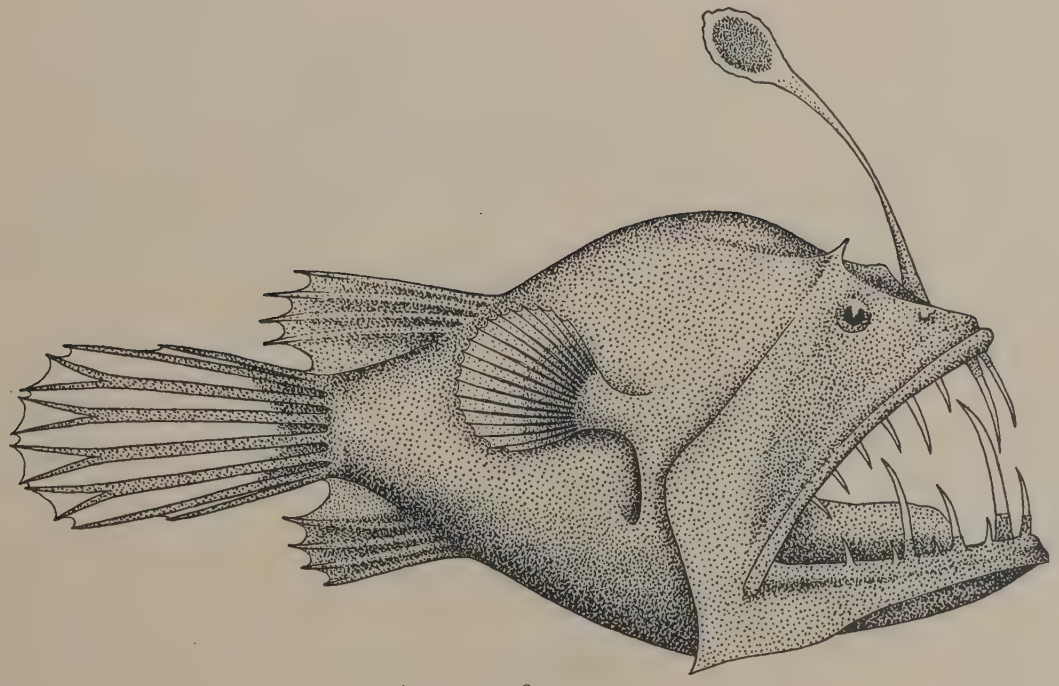

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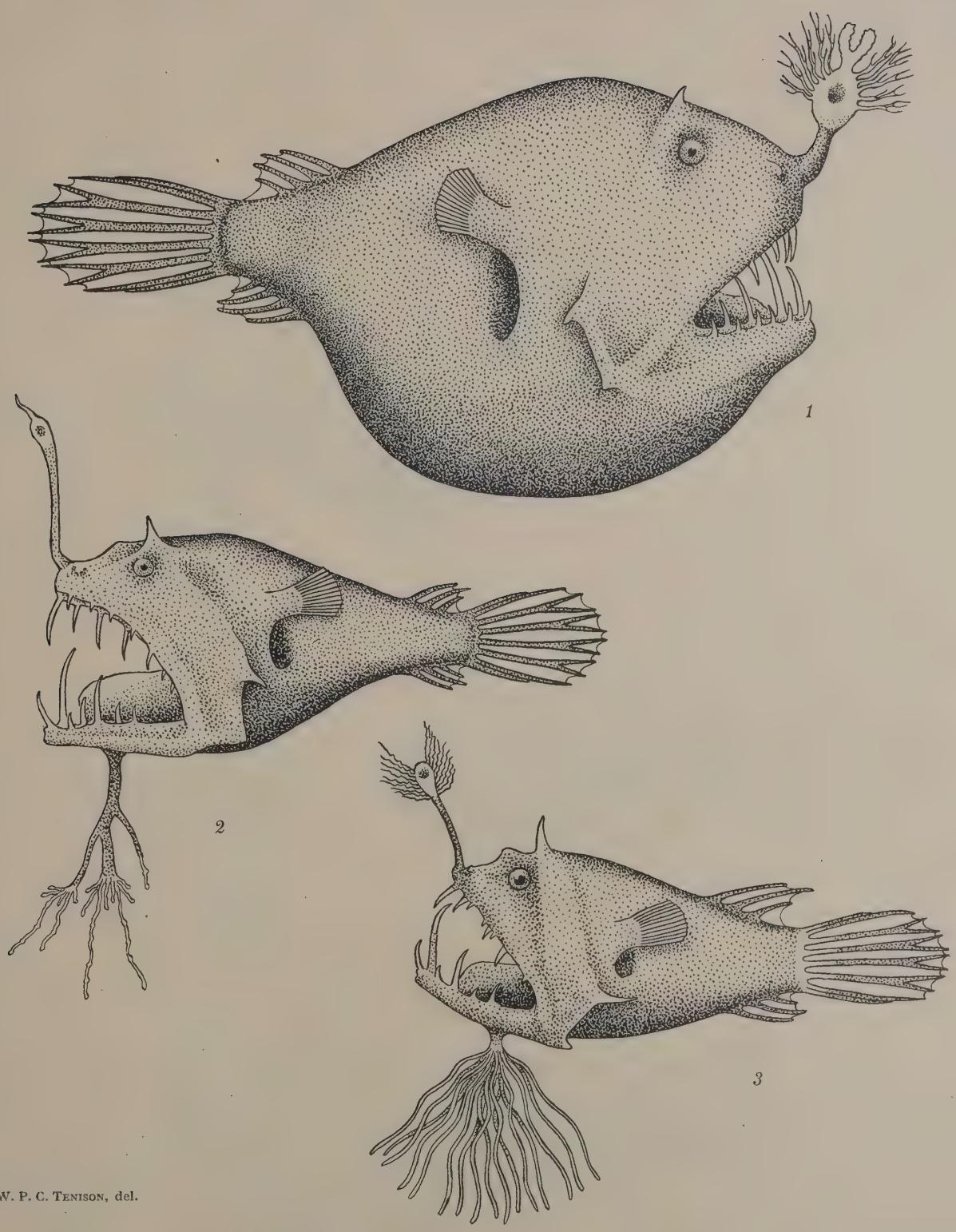
W. P. C. Tenison, del.

Fig. 1. *Photocorynus spiniceps*, Regan. (× 3).

Fig. 2. *Acentrophryne longidens*, gen. et spec. nov. (× 2).



W. P. C. Tenison, del.

Fig. 1. *Borophryne apogon*, Regan. (× 2). Fig. 2. *Linophryne macrodon*, Regan. (× 2).
Fig. 3. *Linophryne polypogon*, Regan. (× 2).

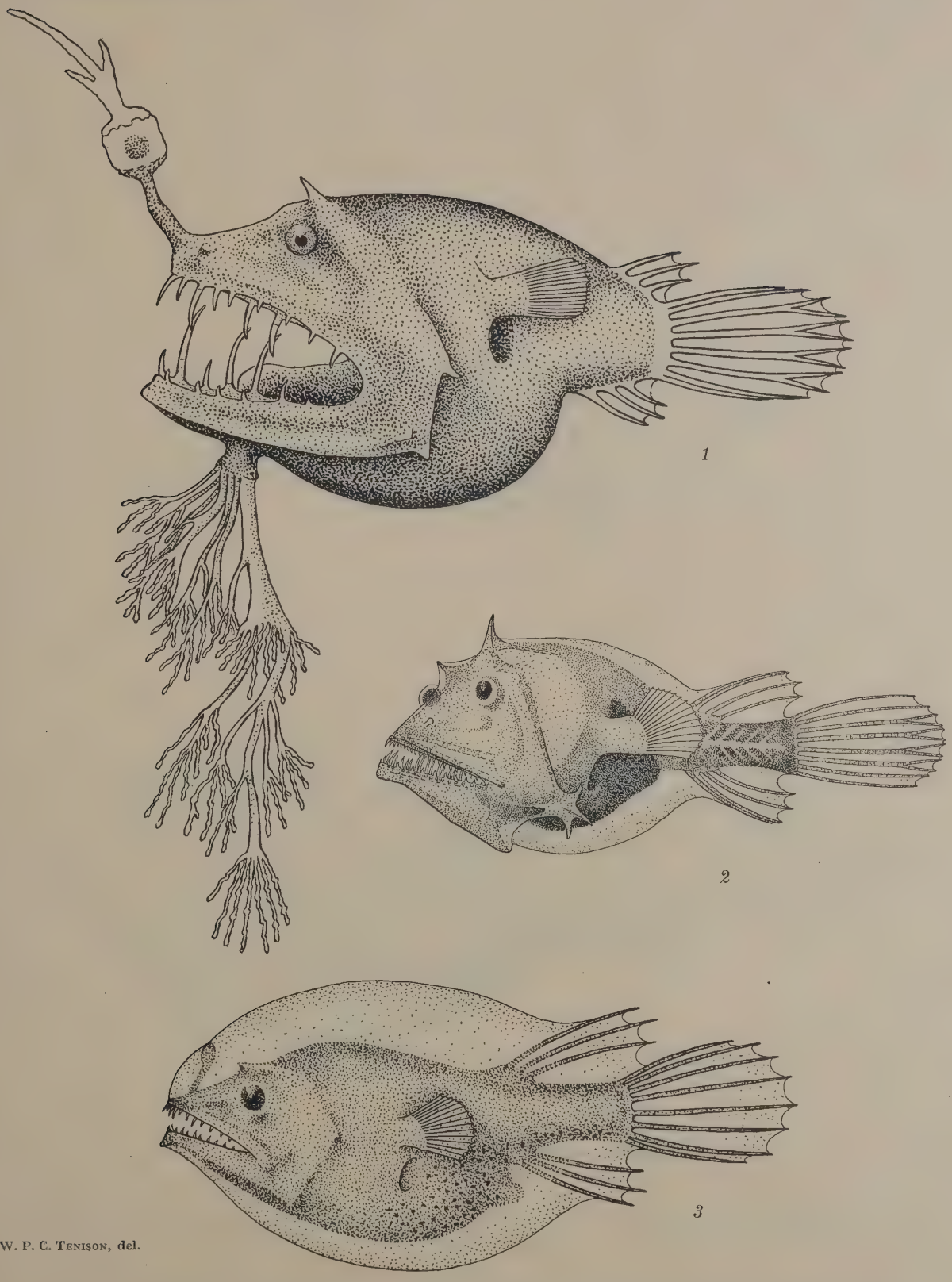
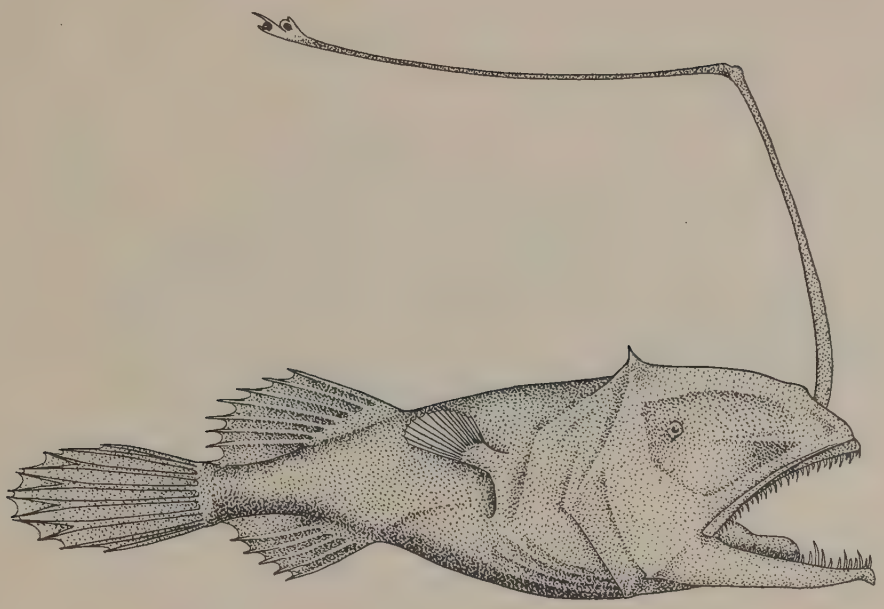


Fig. 1. *Linophryne arborifer*, Regan. (× 2). Fig. 2. *Edriolychnus schmidti*, Regan. (× 2).
Fig. 3. *Haplophryne mollis*, Brauer. (× 3).



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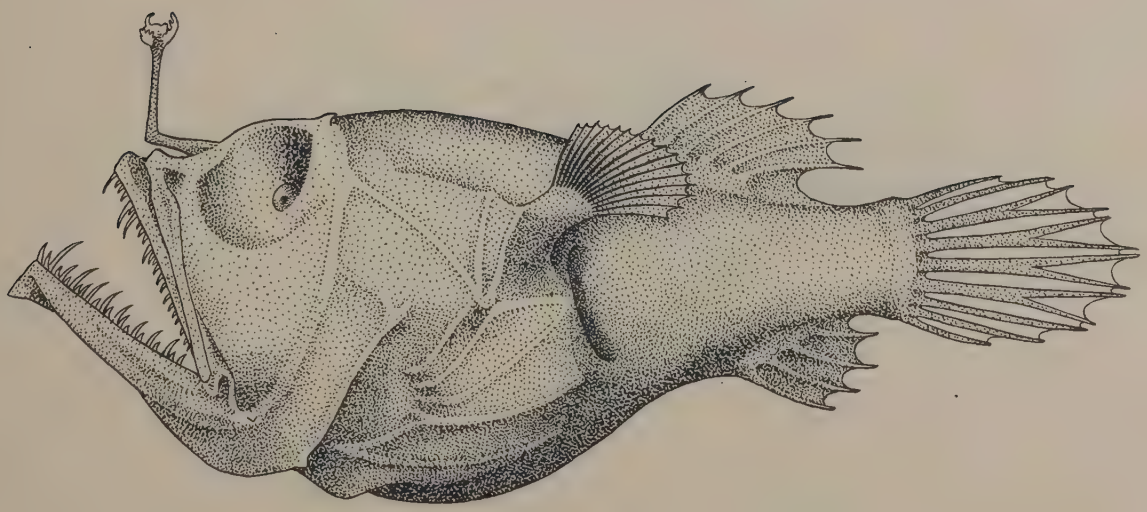
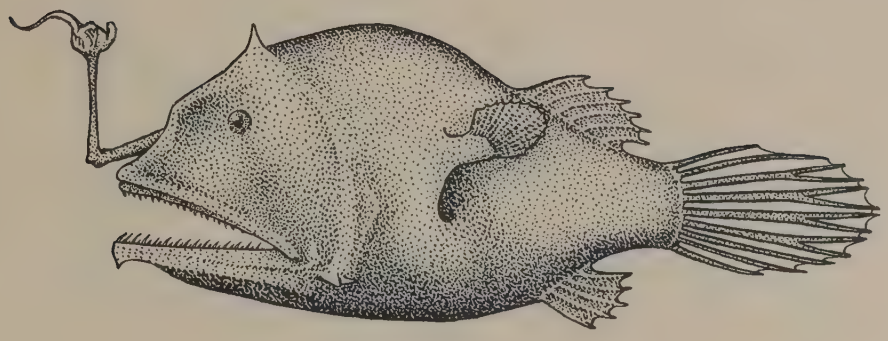


2

W. P. C. Tenison, del.

Fig. 1. *Dolopichthys danae*, spec. nov. ($\times 1^1/_3$). Fig. 2. *Dolopichthys luetkeni*, Regan. ($\times 1$).



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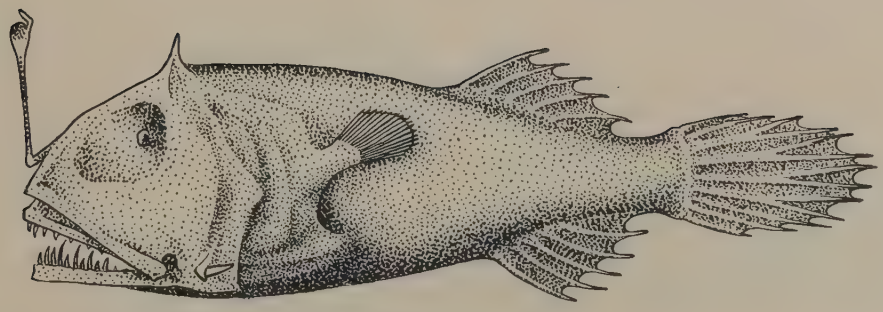
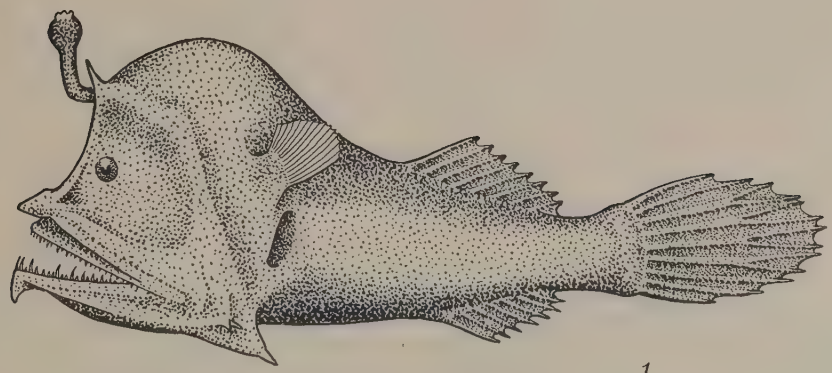


2

W. P. C. Tenison, del.

Fig. 1. *Dolopichthys heteracanthus*, Regan. (× 2⅔). Fig. 2. *Dolopichthys gracilispinis*, Regan. (× 2).



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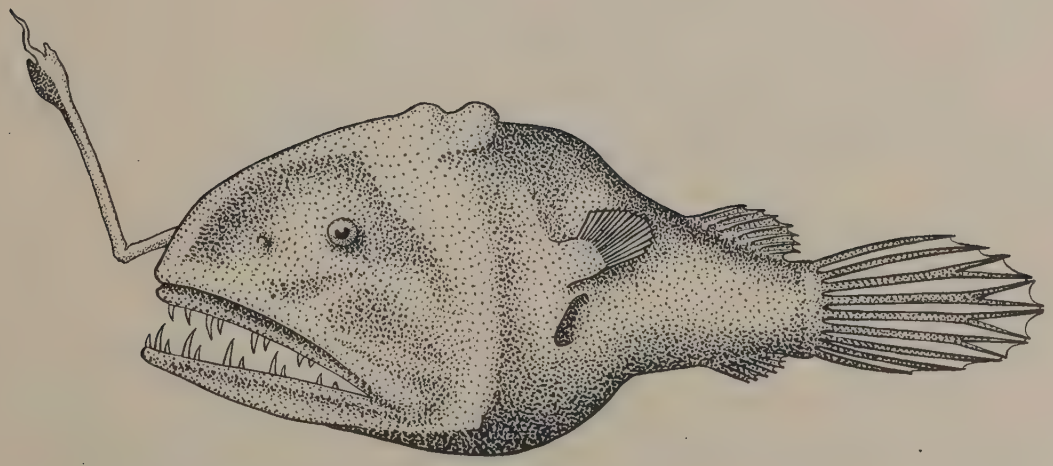
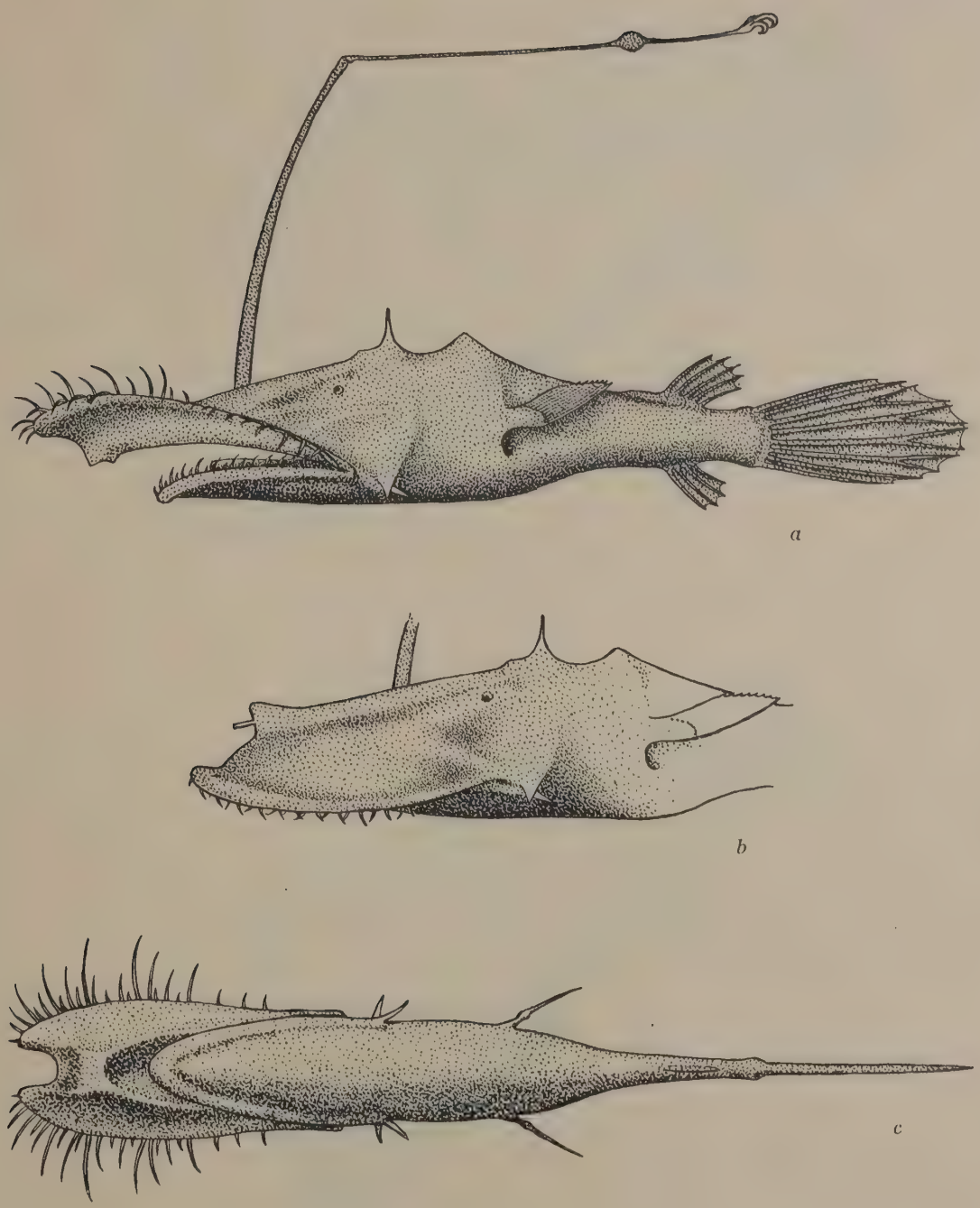


2

W. P. C. Tenison, del.

Fig. 1. *Lophodolus acanthognathus*, Regan. (× 5). Fig. 2. *Chaenophryne longiceps*, Regan. (× 5).



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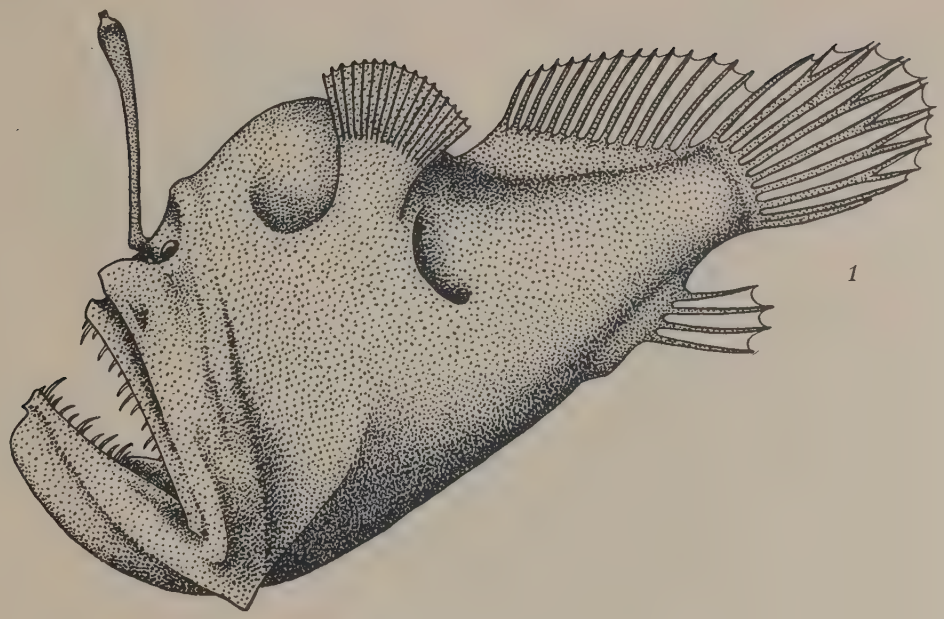
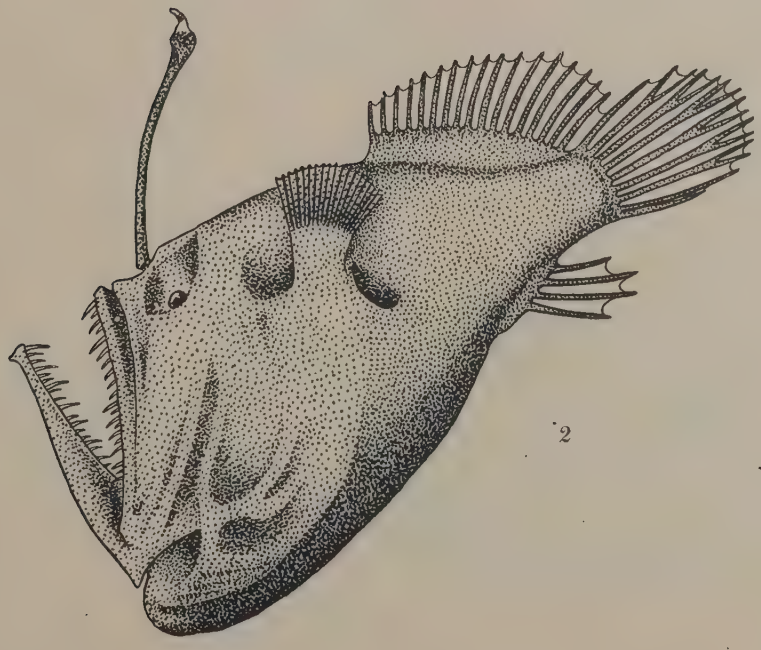
Lasiognathus saccostoma, Regan. (× 2).

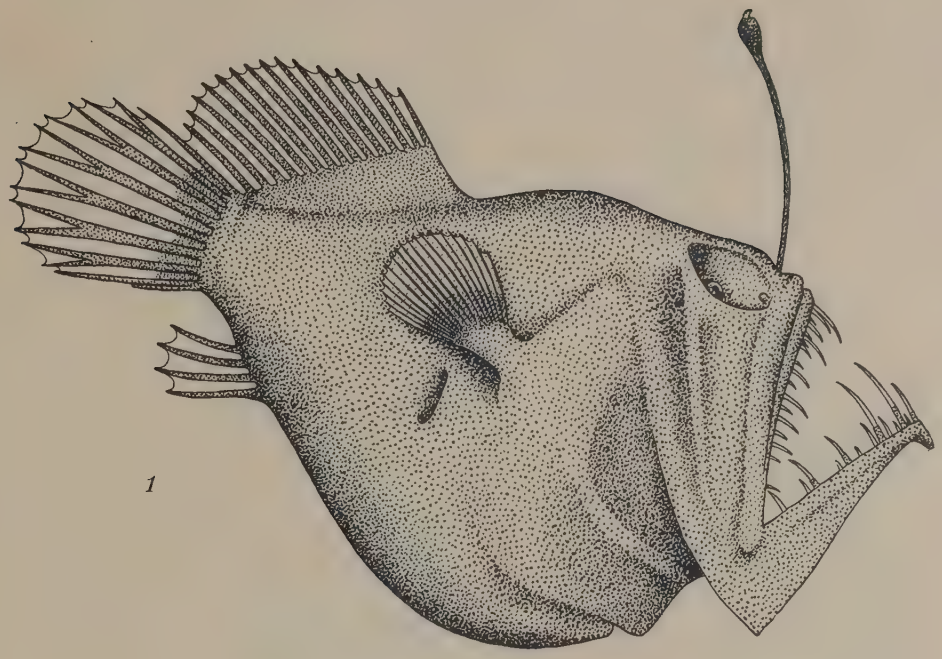
a. Lateral view. *b*. Lateral view of head, with mouth closed. *c*. Ventral view.





W. P. C. Tenison, del.

Fig. 1. *Melanocetus niger*, Regan. ($\times 1^1/_5$). Fig. 2. *Melanocetus polyactis*, Regan. ($\times 1^1/_5$).



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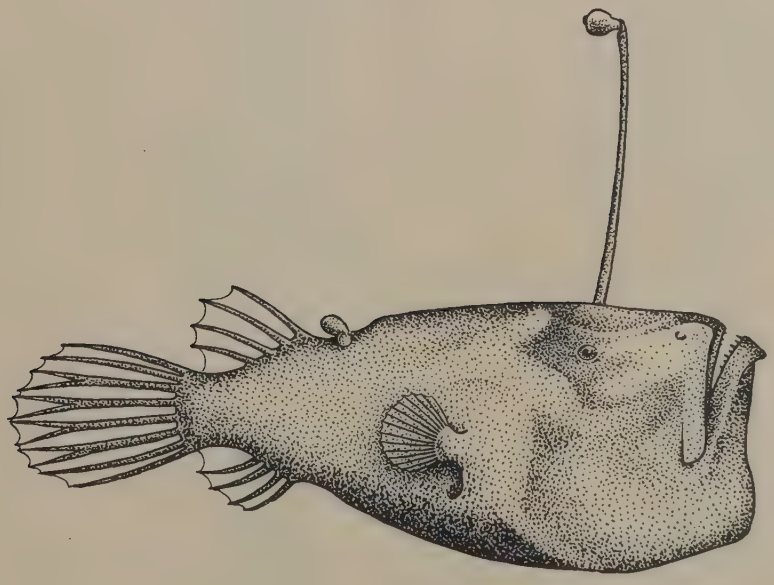

2

W. P. C. Tenison, del.

Fig. 1. *Melanocetus ferox*, spec. nov. ($\times 1^1/_5$). Fig. 2. *Cryptosparas couesii*, Gill. ($\times 3$).

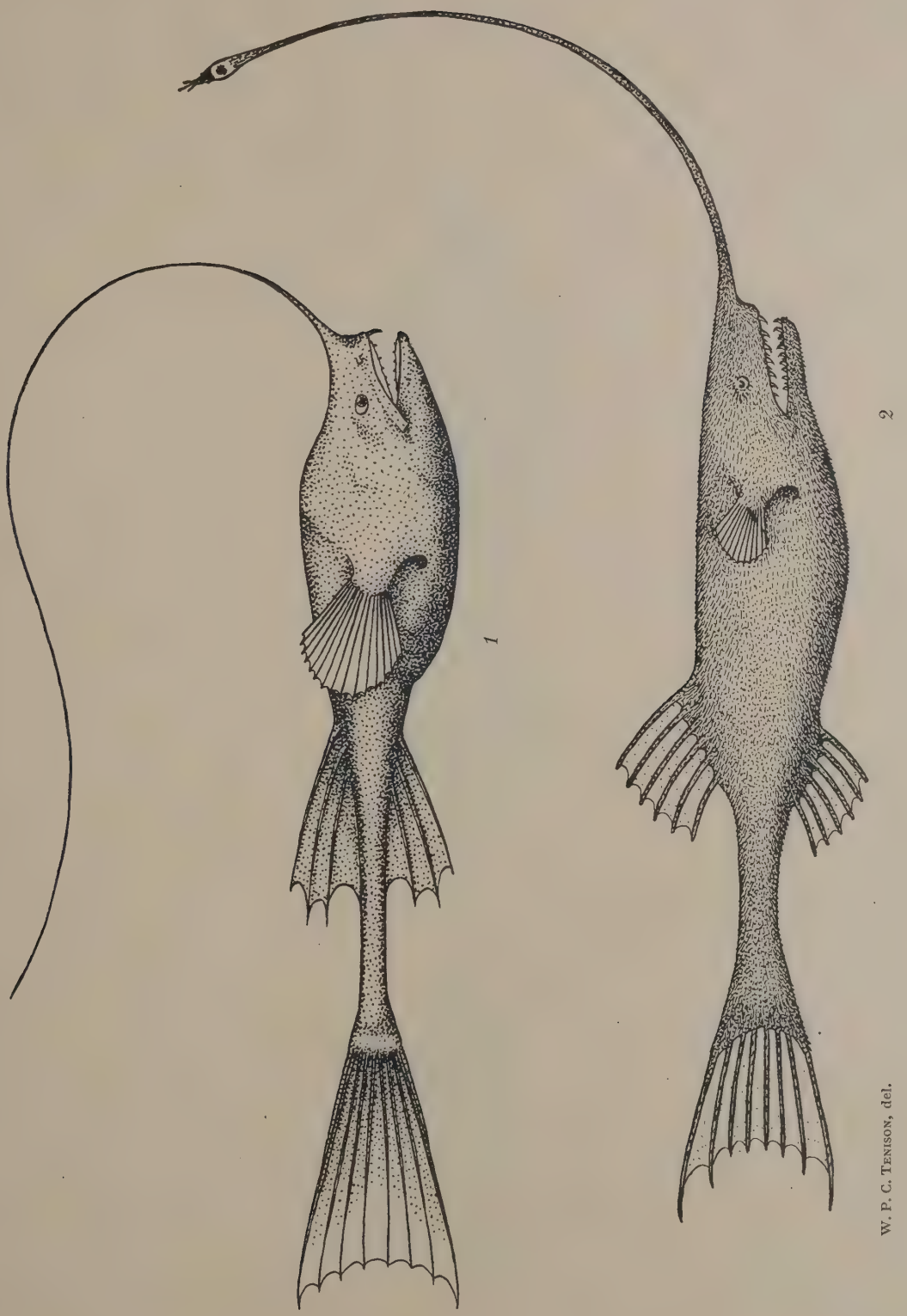

Fig. 1 *Rhynchactis leptonema*, Regan. (× 3). Fig. 2. *Gigantactis gracilicauda*, Regan. (× 1½).

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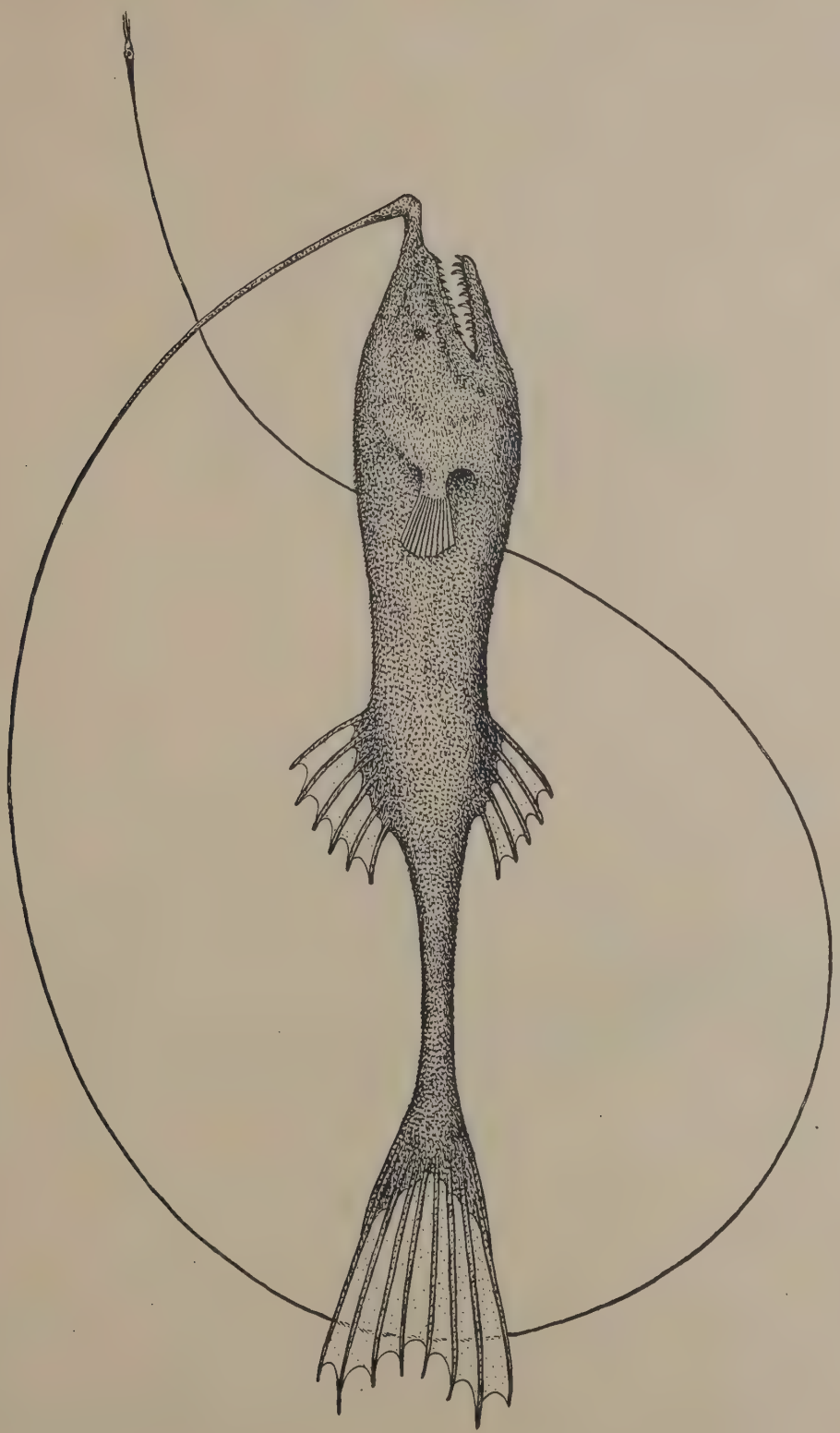

Gigantactis macronema, Regan. (× 1½).

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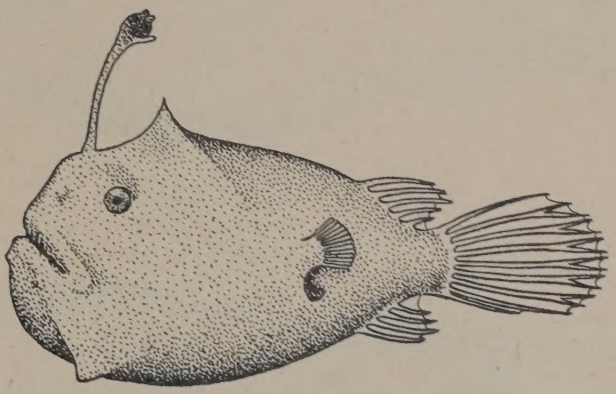

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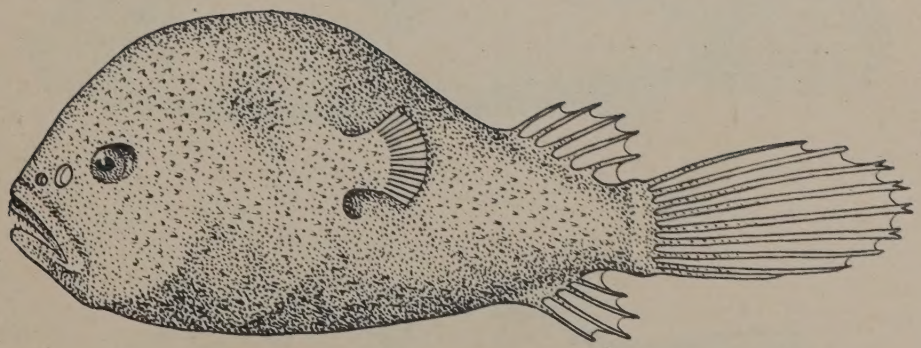
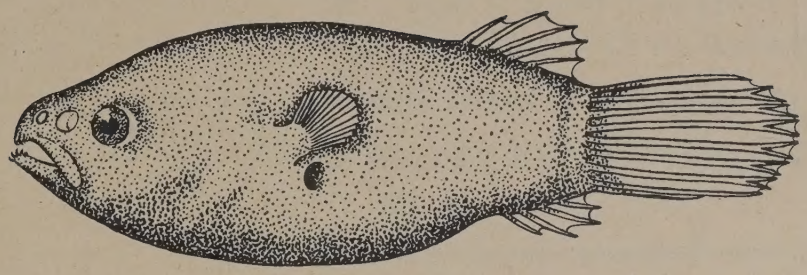


2

W. P. C. Tenison, del.

Fig. 1. *Himantolophus groenlandicus*, Reinhardt; juv. (× 2). Fig. 2. *Lipactis tumidus*, Regan. (× 4).



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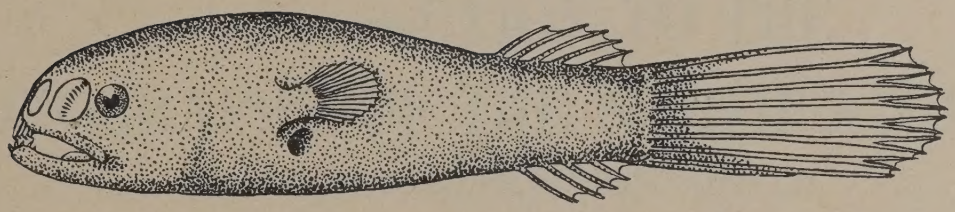

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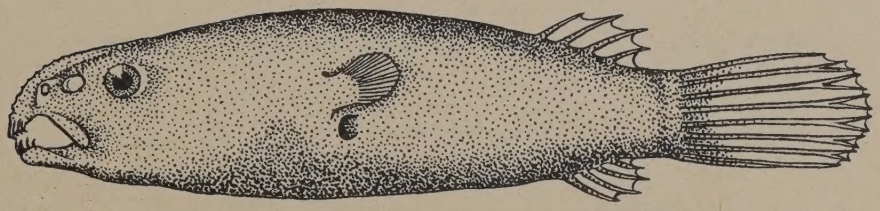

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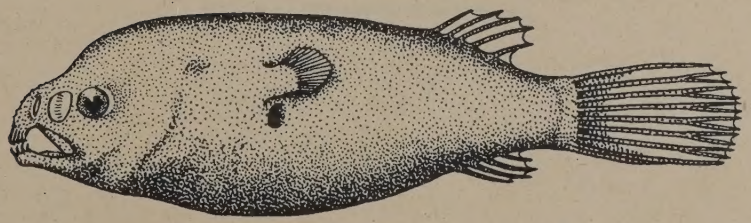

4

W. P. C. Tenison, del.

Fig. 1. *Rhynchoceratias brevirostris*, Regan. (× 3).
Fig. 2. *Rhynchoceratias leucorhinus*, Regan. (× 6).
Fig. 3. *Rhynchoceratias oncorhynchus*, Regan. (× 3).
Fig. 4. *Rhynchoceratias rostatus*, Regan. (× 3).